SEP 21 1927

Telephone Engineer

VOL. 31. No. 9 CHICAGO

Chemistry's Part In Strowger Automatic Design

THE myriad of new products which modern chemistry has produced constitute an immeasurable force for civilization. Their effect on home and industry has been profound.

To make the best use of these materials in the manufacture of Strowger Automatic telephone equipment requires intensive research and judgment of a high order. A new insulating material, suited to certain electrical apparatus, may be utterly useless in Strowger Automatic switches. A new finish, apparently durable, may develop serious shortcomings when analyzed in the light of automatic telephone operation where "durability" means something more than a few years' service.

To put these new products to work in improving Strowger equipment and in lowering its cost to the purchaser, involves problems on which the Research and Development staff of Automatic Electric Inc. is constantly at work.

Automatic Electric Inc.

Factory and General Offices: 1033 West Van Buren St.
Chicago, U. S. A.

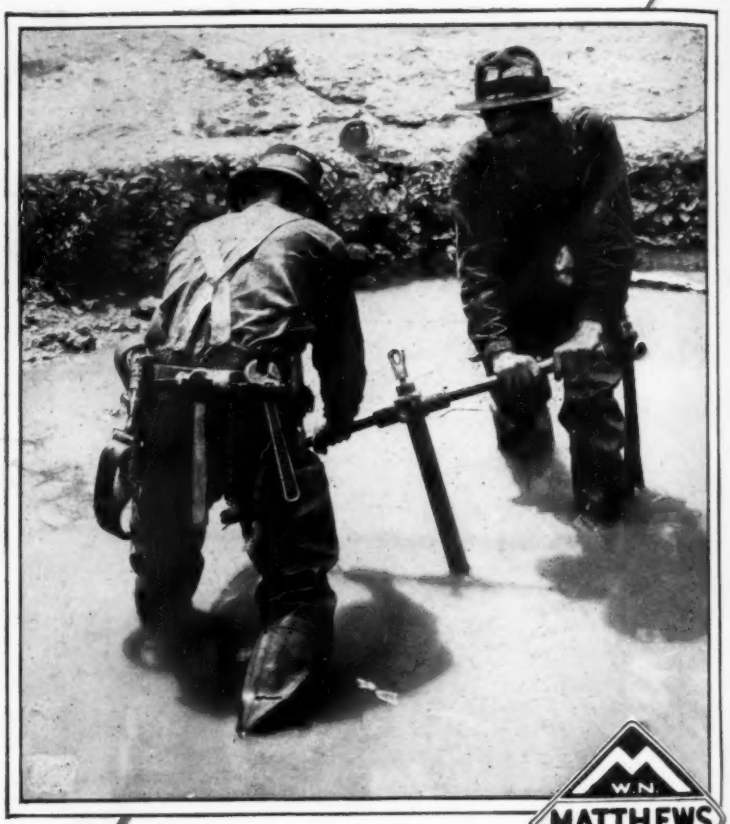
STROWGER AUTOMATIC

SEPTEMBER, 1927

Read These Tests

Users Know from practical experience that Matthews Scrulix Anchors give continuous, dependable service under most severe conditions. Learn why.

In all parts of the world—in wet sand, dry sand, muck, hard pan, disintegrated rock, and under water, these anchors have solved difficult anchorage problems. The following examples are typical—



←*Look for "SCRULIX" on the Helix*

ALLENHURST, N. J.

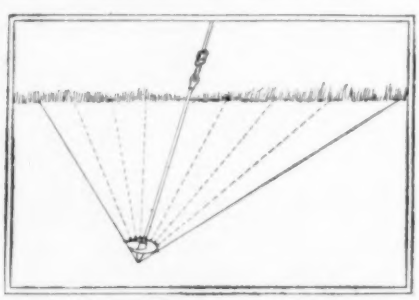
One No. 858-R Matthews Scrulix Anchor was installed with No. 567 Wrench by two men in seven minutes. The ground was sand and gravel. The pull was made by winch on a 5-ton truck from 3/8 inch guy wire attached to the anchor. Guy wire broke at 8700 lbs. Anchor did not budge. Installed two 3/8 inch guy wires and truck backed up. Blocked the truck more securely and pulled beyond the 10,000 lb. capacity of the dynamometer. The indicating hand moved about 2½ inches beyond the 10,000 lb. mark and it was estimated that the strain was about 12,000 lbs. The anchor did not move in the least. Area of anchor 50.26 square inches.

RIVERSIDE, CAL.

Installed No. 758-R, 7 inch Matthews Scrulix Anchor in pure white round silt sand. Two men installed anchor with No. 567 Wrench four feet in six minutes. Pull was made with 5-ton truck winch. Anchor started to move at 5200 lbs. and came out at 5400. Area of anchor 38.48 square inches.

CHATTANOOGA, TENN.

Test on top of famous Missionary Ridge in heavy disintegrated rock. Two men with Matthews Earth Auger and No. 567 Matthews Wrench made complete installation of No. 612-R, 6 inch anchor in 14 minutes. Ten minutes for auger hole 1 man, 4 minutes for screwing anchor down 5 feet 6 inches. Total of 18 minutes on one man basis. In attempting to pull up anchor a tree 16 inches in diameter was nearly pulled over. Engineers were all astonished at results and ability to install in this ground.



The helix of Matthews Scrulix Anchors is so designed that under strain, the lines of force radiate from the anchor helix at 45° angles so that hundreds of cubic feet of earth hold the anchor in place. This principle in Matthews Scrulix Anchors gives a tremendous holding power even in comparatively soft earth.

Write for Bulletin 801

Read the interesting details and gain more thorough knowledge of Matthews Scrulix Anchors. See just what they may mean to you. We will gladly send you this bulletin upon request.

W. N. MATTHEWS CORPORATION
Engineers and Manufacturers
3714 FOREST PARK BLVD. ST. LOUIS, U. S. A.
Offices In All Principal Cities

Your Electrical Distributer Can Supply Them To You

MATTHEWS
SCRULIX ANCHORS
Look for "SCRULIX" on the Helix

97

TELEPHONE ENGINEER, September, 1927. Volume 31. No. 9. Published monthly by TELEPHONE ENGINEER. Publication Office, 236 N. Clark St., Chicago, Ill. Subscription price $2 a year in the U. S. Entered as second class matter June 6, 1922, at the Post Office at Chicago, Ill., under act of March 3, 1879.

Telephone Engineer

Volume 31 SEPTEMBER, 1927 Number 9

Responsibilities of Toll Connections Neglected

It is a strange fact that there are still telephone systems that have not yet developed a consciousness of their relation to other telephone systems and to the service of the country as a whole. Almost any telephone manager can cite cases within fifty miles of his exchange to which it is almost impossible to give toll service because of inadequate lines or defective local conditions.

The failure to fit in is not alone confined to transmission difficulties nor are the smaller companies the sole offenders. Instances might be cited where locally owned companies have been assigned areas in which they are to provide toll circuits and have failed utterly to furnish sufficient facilities to permit prompt handling of the traffic. There are still companies of fairly large size that insist on an inward ticket on all collect calls and others that ticket all inward calls in blissful ignorance or willful disregard of the fact that two-ticket operation has been obsolete these many years. In certain places, travelers and business men find it almost impossible to place collect calls to distant points due to the objections of the telephone company to handling this class of service.

Practically every situation of this kind means lost revenue both to the company that is out of line in its practice and all of the companies with which it connects. Many of them could be eliminated if every company were awake to the fact that it forms part of a nation wide service and nearly all of the others would disappear if all the companies involved in the connection would forget ancient difficulties and approach the matter with a spirit of fairness and willingness to give and take in order to secure the benefits of uniformity in operating practice.

Careless Line Work Gives "Black Eye" to Company

A friend of ours who knows we dabble in telephone business by way of writing, joined a party in which we were included, at lunch a few weeks ago. He had just returned from his vacation and was telling of some of his observations. Directing his remark to the editor of this journal, he said, "The telephone system in Blank County is certainly a tumbledown affair. It is a wonder that it stands up at all and that the people get any service."

We have met the manager of the Blank County Telephone Co. at conventions and he is one of our subscribers. Our impression of him had been that he averaged up pretty well with managers of similar properties and we, likewise, had understood that his company was regarded by telephone men as being a property at least as good as the average of its class. We were at loss to account for the remark of our friend who looks at telephone plants with the eye of a layman, as far as the telephone business goes.

An opportune double holiday gave us the opportunity to plan an auto trip. Our map showed Blank County crossed by the black lines of improved highways so it became our destination. We passed telephone lines of all kinds from the Class A line of the A. T. & T., Long Lines, to the native pole, single wire line of the farmers co-operative. An inquiry at a roadside refreshment stand brought the information that we would enter Blank County a couple of miles ahead.

No further information was necessary to tell us when we entered the territory of the Blank County Telephone Co. for we saw what our friend had seen: to all appearances a rundown, decrepit telephone line. Poles leaned in every direction, cross arms were crooked with here and there a brace hanging for want of a heel bolt, wires were slack and uneven, corner poles were innocent of guys. We saw plenty to justify our friend in his opinion of the system.

There were things, however, that our friend did not see which did not escape our observation. The poles had creosote treated butts and the brand of the pole supplier showed that they were less than three years old; the hardware was galvanized and trees had been trimmed so that scarcely a twig touched the wires. We failed to notice a single missing or broken insulator. As far as our inspec-

tion showed every item of material was first class and the entire line was practically new.

Our speedometer dials clicked around as we passed through a couple of villages and the county seat town where line conditions were not much different than those we first saw. Finally we passed on from the roads of Blank County to other roads and saw other lines; lines built of no better material than those of Blank County but having that intangible element of finished workmanship. Naturally our speculation ran to the question of why an otherwise progressive company, as we have reason to believe the Blank County Company to be, would do its construction work in a fashion that left the casual observer with the idea that it is a "tumbledown affair." We have not yet found the answer.

Buying Fever, Dying, Leaves Some Good in Its Wake

As time progresses, it is becoming possible to observe some of the effects of the recent wave of changes in ownership of telephone properties even if the exact trend of future development can not be foretold. Reports coming to us indicate some slackening of activity in purchasing and selling. The sales now being reported are, in the majority, cases where negotiations were begun or completed months ago. Such property as remains for sale is being held at prices that will make the experienced buyer hesitate before agreeing to purchase. Out of eight or nine thousand independently owned companies, the best estimates we have available indicate that about five hundred have changed hands.

One class of changes that has been taking place is the absorption of a group of smaller companies by a neighboring larger unit. These changes have been worked out largely by telephone men and result in the acquisition of less progressive systems by a more active and aggressive company. Financial plans in the main have been conservative and the element of successful management is present in the proved capacity of these in control of the combined property. This class of changes gives little cause for concern as to the future welfare of the industry and probably will result in positive benefits.

Another class of changes, is the passing of control of many individual companies into the hands of holding companies. Some of these holding companies are managed by telephone men of long experience with adequate financial backing while others are too new and unseasoned to permit judgment as to their ability to meet the problems of the industry. As we have pointed out before, there is no magic in the holding company form of organization and the results of grouping companies under holding company control will depend upon the type of management that the holding company can put into the local property and the assistance it can give from its general headquarters.

A third class of changes is the acquisition of property by interests not previously identified with the telephone business. This is bringing men of no previous telephone experience into the field. Ultimately much good can come from this infusion of new blood. Ideas will be brought from other fields and, while they may not always be in accord with telephone traditions, what is good in them will be recognized and will become part of future telephone practice. Some of these men and some of their ideas will be failures while others will be successes and will make valuable additions to the personnel and practice of the telephone art.

There is still reason for concern as to the possibility of financial success of some of the newer companies but it now seems that the speculative fever will have run its course before any damage occurs to the industry that is comparable to the difficulties that have arisen in the farming industry as a result of wild speculation in land that took place a few years ago in some of the middle western states.

Present indications are that there is a large section of the independently owned industry that will not be affected by the present era and which will act as a stabilizing force to prevent any radical changes in the industry. The industry as a whole will go along in its development on sane, conservative lines that has made the telephone service of this country stand out above that of all the other nations of the earth.

Pick with Care from Candidates for Steady Jobs

In a few weeks construction programs will be well on their way to completion and the inevitable time for laying off extra help will come. Each year a number of those employed as extra help, earn their places as permanent members of the force to replace those who drop out and to supply the need of larger forces due to growth of the business. The annual building up and laying off of construction forces provides an excellent weeding-out process which enables a company to maintain a satisfactory quality of recruits for its permanent staff. Just now, supervisory employees are studying the qualifications of employees on the temporary pay-roll so that no promising man may be allowed to slip away into other pursuits through lack of opportunity to establish a permanent connection.

Practical Suggestions for Plant Valuation

By CHARLES W. McKAY, M. E.*

CHAPTER III.

In the last installment we considered the subject of the valuation of the city, rural and toll pole and wire plant. We passed over this phase of the subject rather hurriedly—in a preliminary way.

I wish to call attention to the fact that all data pertinent to the poll and wire plant should be recorded most carefully. One thought suggests itself—which may arise as a question in the readers' mind—and that is that it has been suggested that the city pole and wire plant be recorded item by item (in other words, pole by pole) while the rural and toll plants are taken in long mileage runs. The reason for this will be apparent if we but stop to consider the fact that the toll and rural plant is more or less homogeneous. In other words, we may have five or more miles of 25 foot 6 inch top poles—each equipped with about the same miscellaneous paraphernalia.

In the city, however, the problem is different. The poles, as a rule, are higher (and therefore more valuable) and the anchoring and guying equipment varies at frequent intervals.

The subject of our line wire was only briefly touched upon in the August installment. In towns and cities a large amount of twisted hair wire is used. Much of this parallels the pole line—coming from various cable terminals. It is a good plan to consider all wire paralleling a pole line as line wire—and to record the wire from the house to the nearest pole as drop wire.

If we adhere to this simple rule, much confusion may be avoided.

In conjunction with Figures 2 and 3—incorporated in the August installment—reference was made to the columns for "Condition." I do not wish to enter into a discussion of the subject of depreciation at the present time. This subject will be discussed in its entirety, in a subsequent installment. However, to avoid confusion it may be well to outline a few of the fundamentals of the subject of depreciation.

The Century dictionary defines "depreciation"—as "a falling in value; reduction in worth," while the Standard dictionary defines "depreciation" as a "lowering in worth." Another definition—and a most excellent one—is given by Dr. R. H. Whitten in his book entitled "Valuation of Public Service Corporations." This definition follows:

"Depreciation can be defined as the lessened utility value caused by physical deterioration, or lack of adaptation to function."

There are numerous causes of depreciation. From our present standpoint—that of valuating a going telephone property—these may be classified as follows:

1. Depreciation due to wear and tear.
2. Depreciation due to age or physical decay.
3. Depreciation due to inadequacy.
4. Depreciation due to obsolescence.

In evaluating a going telephone property it is the first two causes of depreciation in which we are primarily interested. Of course, when making an inventory we have no means of knowing as to what portion of the plant is inadequate or what portion of the plant is obsolete. In other words, we record what we find.

"Wear and Tear" Depreciation

For a moment, let us consider wear and tear depreciation:

The depreciation due to wear and tear as the term suggests, is that lessening in value resulting from actual use or service. This class of depreciation does not play as important a part in the depreciation of telephone properties as it does in the depreciation of industrial plants. As an illustration, machinery which is in constant use naturally wears out and has to be replaced. This wearing-out process is the direct result of use.

A telephone plant, on the other hand, is composed largely of poles, cables, conduit, wires, subscribers' instruments and central office equipment. It will be readily seen that these items of plant are not subjected to any vigorous mechanical use, with the possible exception of portions of the central office equipment. In other words, telephone property depreciation is more largely due to age, physical decay, inadequacy and obsolescence than to wear and tear. There are, of course, exceptions to this rule. The cords, for instance, of a central office or private branch exchange switchboard are subjected to constant friction in the sockets through which they operate, and often wear out rapidly, due to actual use, or, in other words, to wear and tear.

This, however, cannot be properly cited as an illustration of wear and tear depreciation for the reason given in the following paragraph.

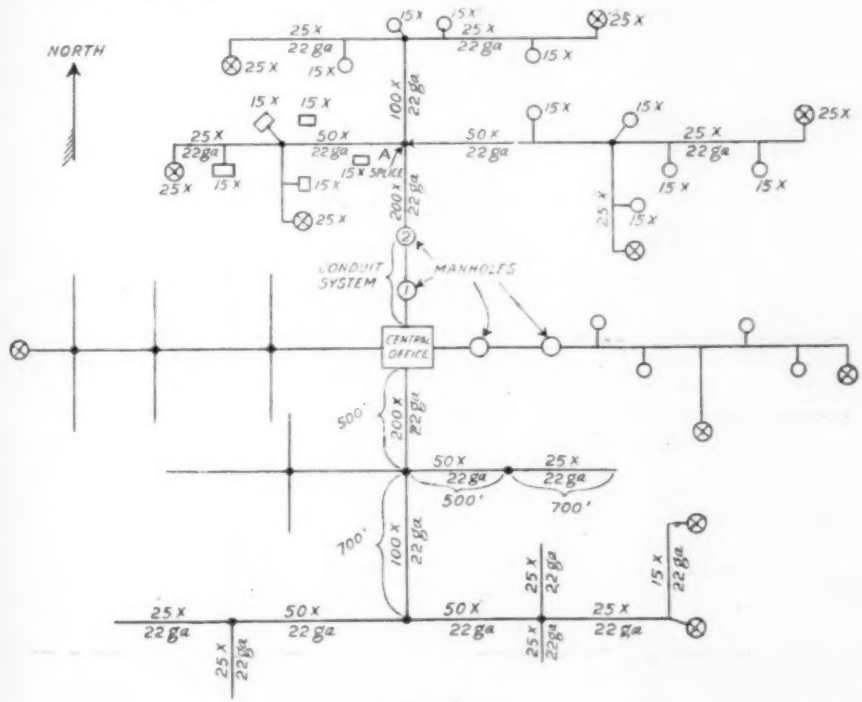


Fig. 4

Consulting Telephone Engineer, Wrigley Building, Chicago, Ill.

In connection with the subject of wear and tear depreciation there is one point which should be clearly borne in mind. The lessening in value of any item of equipment which is made up of a number of small and replaceable parts is naturally somewhat offset by current repairs. Take, for instance, the case of a subscriber's instrument. The receiver shell, transmitter, cords, ringer and induction coil are necessarily replaced from time to time in connection with plant maintenance. Thus a subscriber's set which has been in service for a long time may be found, on appraisement, to be in almost as good condition—so far as practical operation is concerned—as a new set.

This is due to the fact that the elementary parts are replaced as fast as they become defective. Telephone accounting, in fact, sanctions the inclusion of the cost of such minor replacements as a part of the operating expense of the plant. Nevertheless, there comes a time—no matter how carefully the plant may be maintained—when the cumulative effect of wear and tear depreciation becomes apparent, when it is cheaper to discard the apparatus entirely than to try to maintain it by further minor replacements of its elementary parts.

Another factor to be taken into consideration in connection with inventory and appraisal is the depreciation resultant from age or physical decay.

This phase of physical depreciation plays a most important part in the depreciation of telephone properties. Depreciation due to age and physical decay is largely dependent on current repairs or replacements.

It makes little difference whether a telephone cable or a pole is in constant use or whether it is allowed to stand idle; the depreciation is just about as rapid in one case as in another, and this is due entirely to natural causes, i.e., age and physical decay.

In appraising a property and determining its present sound value, we are interested only in what we see. We have no means of estimating the factors of inadequacy and obsolescence.

Some people are prone to confuse the problem of annual depreciation with that of accrued depreciation as found at the time of appraisal.

Depreciation Differences

In considering the two allied subjects of depreciation and annual depreciation, it is well to remember that they may be viewed from entirely different standpoints—the standpoint of the engineer and the standpoint of the accountant. Professor Earl A. Saliers of Yale University, in the preface of his work on the "Principles of Depreciation" clearly outlines these points of view—as follows:

"The depreciation problem may be viewed from two standpoints—that of the accountant and that of the engineer. The engineer deals with physical conditions, studies plant deterioration, etc., the accountant devises ways and means of recording, in the most intelligent manner, the facts in connection with these changes. The work of the two should be correlated through a common understanding of the character and extent of depreciation. The engineer having shown what the rate of depreciation is, the accountant suggests the devices for recording it, for providing replacement funds, etc.—and thus for the preservation of capital values."

To further emphasize the subject, I quote another authority on depreciation.

"If this fundamental difference (the difference between the engineer's viewpoint and that of the accountant) is kept in mind," says Mr. Thomas, "there will be no feeling on the part of the appraisal engineer that the accountant is 'depreciating' the plant values excessively; nor will the accountant, on the other hand, view the depreciation made by the appraiser as grossly inadequate.

"Putting the proposition in a mathematical form, let x equal the amount of actual depreciation that has taken place and y the amount of increase to provide a reserve fund for future contingencies and replacement. The function of the appraiser is to ascertain the value of x; the function of the accountant is to take x and determine what y would be. Manifestly if the appraiser terms x the actual depreciation, and the accountant declares that x plus y is the actual depreciation, they will never agree. This shows that there should be a careful study that would lead to a mutual understanding of each other's views of depreciation, so that when one says, 'this is the actual depreciation,' it would mean the same thing to both. It will also be observed by this formula that the accountant is dependent upon the appraiser in order to known the amount of x.

"It is not uncommon to hear the claim made that the plant has depreciated to an amount represented by the balance to the credit of the renewal fund. Were it not for the fact that many engineers are following the practice of using so-called standard tables in estimating present depreciation, deducing in proportion to the age of the plant, it would seem necessary to treat this claim seriously.

"The establishment of renewal funds through 'depreciation' annuities can be likened to the accumulation of a fire insurance fund on a building. A building that has not yet burned has certainly lost none of its value by reason of a fire insurance fund existing to insure it; neither has a plant lost value because of a renewal fund that exists to insure its gradual or final replacement. On the contrary, the fact that such a renewal reserve is being maintained is the strongest argument that all that is possible is being done to provide against impairment of investment and impairment of efficiency.

"It is obvious that the renewal fund will accumulate faster than is really necessary in the earlier years of a plant's history because the replacements during the earlier years will be comparatively few, but that after a number of years the expenditures for replacements and the contributions to the funds will somewhat more nearly balance each other.

"It is evident that the percentage of depreciation that would show the present value should be a different amount from the percentage used to establish a renewal fund. Some authorities call the latter 'theoretical depreciation.' It might better be termed 'safety-first' depreciation.'

"Theoretical depreciation seldom, if ever, works out in practice or actual experience, for the reason that it assumes a gradual constant reduction in the value of property during its life. It requires no argument to show that actual depreciation does not occur that way. The so-called 'average life' of a plant complicates the problem of depreciation. The use of this term creates the impression that the plant lives to the term set by the average life and then has to be renewed as a whole. Nothing could be farther from the truth. A property is not like human life; no mortality table applies. Renewals in a well-managed going concern are of constant occurrence. The plant is never wiped out and then entirely replaced except in the event of some calamity, like a fire or tornado; or, if it is, the occasions are very rare and hardly

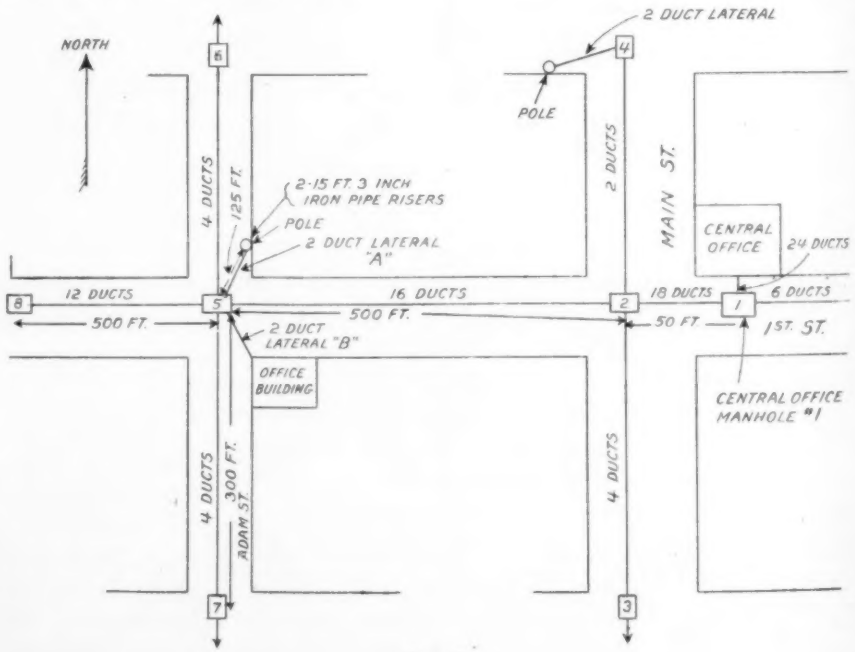


Fig. 5

worth consideration. In such an event the actual sound value, or insurance value, should be sufficient to replace it in as good shape as it was when the catastrophe occurred.

"This could not be done if settlement were made with the insurance companies on the basis of depreciation shown by 'depreciation reserve account.' This is not saying that 'theoretical depreciation' is not right for its purpose. It is only wrong when it is substituted for and treated as actual depreciation. On the other hand, it is as wrong to take only the actual depreciation and say that it is a sufficient amount to provide the actual depreication and say that it is a sufficient amount to provide for replacement. Actual depreciation is an impairment of capital, while the additional depreciation is a provision to preserve capital intact.

"Some authorities hold that it makes no difference, and that the appraisal engineer is not interested in the purpose for which the valuation is to be used. So far as ascertaining the reproduction value is concerned this is true, but it does not apply to the percentages that are deducted from the reproduction value. In other words, the expert should know for what purpose his depreciated figures are to be used, and the depreciated value should state what it intended to show. This does not affect 'the basis value of new replacement.'

"We have seen that a percentage deducted, which would be adequate for the actual depreciation, would not be adequate to provide a renewal fund. Again, if one were to calculate the sales' value of a certain property to be removed and used elsewhere, he would be face to face with certain peculiar conditions. The appraiser must know these peculiar conditions. To illustrate: The removal of a special machine to some other place, for use in connection other than that for which it has been installed, might necessitate such a large expenditure for modification of design in order to make it useful elsewhere that it would have little value after the expense was paid. To show this machine's sales value would necessitate a large percentage of deduction from its value to a going concern in its original place. Manifestly a sufficiently heavy percentage of depreciation to show a 'removal-sale value' would be absurd to use as the actual value to a going concern.

"If one terms these different deductions 'depreciation,' it follows that a correct method of estimating depreciations for one purpose may be an incorrect or inadequate method to apply for another purpose.

"A wise procedure is to maintain the plant in efficient condition through repairs and minor renewals paid from current income. The final renewals are made as required, and the cost debited to the renewal reserve account. Each year there is debited to loss and gain, and credited to final renewal reserve account, the amount indicated by the estimate based upon the expectation of life of the several units of the plant.

"It is important that, where reserve is debited on account of liability for future renewals, when those renewals are made the expenditure therefor should be charged against renewal reserve account and not against the year's operating expense; otherwise the reserve would be building up indefinitely, and the loss and gain account would show faulty conclusions."

The above quoted citations should prove invaluable if you are attempting to prepare your own inventory and valuation. However, the writer would advise that you adopt the suggestions incorporated in the earlier installments of this series. Make your own inventory—and possibly prepare your own unit costs—but do it under the supervision of a valuation and rate expert. The cost of such service (if you make your own inventory, etc.) is negligible—but the results are bound to prove more satisfactory.

An Illustration

To paraphrase all of the foregoing I will give a simple illustration. It is the unexpired life of the plant we are interested in rather than the expired life. In Illinois it is generally conceded that the average life of poles is from 16 to 18 years. The writer has seen poles 12 or 15 years old that are in excellent condition and may last for 10 or 15 years more. Very well. Let us take a case of a pole line having an estimate life of 17 years. Suppose we examine this pole line carefully—butt-testing all of the poles and giving due consideration to core rot, etc.—and we find that the poles are good for at least 9 years more of useful service. Obviously, these poles would take a very high condition per cent—despite the historical data as to expired life.

I cannot emphasize this point too strongly—do not confuse your light tables as used for accounting purposes in computing annual depreciation rates with the present condition of the property as found by personal inspection in the field.

Aerial Cable; Exchange Account 242 and Toll Account 252

Quoting the instructions of the Interstate Commerce commission, "These accounts should include the cost of cables, including the cost of suspension spans, cable clips and rings, cable boxes and fittings, pole seats and platforms, loading coils, pot heads, protectors, sleeves and other material used in hanging such cables."

Before starting the inventory at the Aerial Cable Plant all available data as to location, size and age of cables, size of terminals, etc., should be reviewed. If these data have not already been assembled in map form a skeleton map such as shown in Fig. 4 should be made.

A very simple way to inventory the aerial cable plant is to use a skeleton map of the type suggested in Fig. 4.

The illustration has purposely been made simple—but it will serve the purpose. Looking North it will be noted that several manholes are shown. From manhole No. 2 a 200-pair 22 gage cable extends northward.

In inventorying the plant sizes and gages of cables should be recorded (as suggested in Fig. 2) and also the sizes and types of terminals. A simple code, for the terminals, is to use a circle with a cross for a protected terminal and a circle without a cross for an unprotected can-top terminal. The Western Electric No. 14 terminals (or equivalent Cook Electric Company terminals) may be designated by a square.

Measurements can be recorded directly on the map—as indicated (in Fig. 4) to the South of the central office.

The following points should be noted by the Field Inspectors in the inventory of the aerial cable plant:

1. Size (number of pairs), gage and length of each cable. The length should be determined by actual measurement with a surveyor's chain. It is usually best to record the length between each pair of terminals.

2. Diameter, tensile strength and material of messenger strands.

3. Type and size of cable hangers; note specifically whether the marlin, ring or Metropolitan type of hanger is used.

4. Type and size of terminals, and whether protected or unprotected. If protected, note the number of pairs equipped with protectors.

5. Condition of cable, strands and terminals.

The inventory of the underground plant—in the case of small telephone companies—is so closely allied to the inventory of the Aerial Cable plant, that I am going to briefly outline the method of procedure of appraising the underground plant, in this article. It may be advisable to enlarge upon this subject in a subsequent installment.

I. C. C. Instructions

First, let us review the instructions of the Interstate Commerce Commission.

Referring to underground conduits, exchange account 244 and toll account 254, the Commission says:

"This account should include the cost of service conduits, including the cost of pipe, cement, handholes, manhole furnishings and other materials used, the cost of connections to poles and buildings, repaving and other costs incident to the installation of such conduits."

"The inventory of the underground plant for a small exchange is usually a comparatively simple problem. In all probability the subway will be found to extend only a few blocks from the office, the cables few in number, and the manholes readily accessible for inventory purposes. When it comes to the underground plant feeding the congested section of a large city, however, the problem becomes more complicated, and unless the utmost care is observed in the taking and recording of the data, the inventory will result in a hopeless tangle."

With respect to account 245, exchange underground cable, and 255 toll underground cable, the Commission says:

"This account should include the cost of exchange service underground cables, including cable boxes and fittings, loading coils, and other materials used in the work of installing such cables, and other costs incident thereto.

"It should include, in addition to the main exchange underground cable, the subsidiary cables through laterals to pole

for building terminals; the subsidiary cables to the interior of city blocks for connection with interior block wires; and the subsidiary cables entering vertically—as house cables—into buildings for connection there with the inside wires.

"House cables are considered to be vertical extensions of underground cables or plant similar thereto. They do not include the inside wires extending from terminal boxes of house cables to subscribers' stations, nor the cables for subscribers' private branch exchange switchboards, which are included in Account 232, Station Installations."

I have often found small, or medium sized, telephone companies progressive and up to date in every other respect but almost entirely lacking in records. As a matter of fact, the records are often carried in the manager's or wire wire chief's head. Where records are lacking I would suggest that you sit down and make a layout similar to that suggested in Fig. 5.

For purposes of illustration, I have shown the Central Office at the corner of Main and First streets, with 24 ducts going from the Central Office to a large Central Office manhole—this manhole being designated as manhole No. 1.

Six ducts are shown going to the east and eighteen ducts to manhole No. 2 at the west.

The rest of the diagram may be followed readily by the reader—it being noted that center to center manhole, trench foot measurements are entered upon the map. At the corner of First and Adams streets an office building is designated. Two ducts are shown from manhole No. 5 to the office building.

North from manhole No. 5, at the east side of the street, a pole is shown. Two ducts extend from manhole No. 5 to the pole, with two 15-foot three-inch iron pipe risers. All of this data can be recorded upon the underground conduit layout and also, if necessary, the cable data. I have not attempted to illustrate the method of recording the cable data on the map suggested by Fig. 5. This subject, together with an application of the underground conduit and manhole inventory problem, will be discussed in the October issue.

British Forecast Radio Telephone for 1928

London, Eng.—A public telephone service between the United Kingdom and all the British Dominions is forecast by F. G. Kellaway, managing director of the Marconi company and former British Postmaster-General.

Mr. Kellaway said that there was every prospect of its establishment next year, as well as that of a system of transmitting pictures, drawings and written and printed matter by radio.

"Experiments have proved the possibility of carrying on radio telephone conversation by means of beam stations simultaneously with the radio telegraph.

Fred Baer, Automatic Genius, Killed in Auto Crash

Chicago, Ill.—Frederick L. Baer, for nearly twenty-five years a member of the staff of Automatic Electric Inc. and more recently the company's commercial manager, died Tuesday evening, September 6, at Dodgeville, Wis., as a result of injuries sustained when his car was crowded off a narrow highway near that town while on a short vacation trip. He

Frederick L. Baer

was accompanied by Mrs. Baer and Mr. and Mrs. Hazlett of La Grange, all of whom also sustained injury.

One of the foremost telephone engineers in the country, Mr. Baer was held in the highest esteem by the whole profession both here and abroad, not alone because of his wealth of engineering knowledge and experience, but also because of his close personal contacts, his sympathetic understanding of human problems and his keen devotion to the business of which he had formed an increasingly important part.

Entering the employ of Automatic Electric Co., after graduation from Notre Dame University in 1903, when the automatic telephone business was still in its infancy, he attracted immediate attention because of his innate ability to grasp the essentials of a problem, to study them quickly and thoroughly, and to render prompt and accurate judgment.

Realizing the value of practical experience, he became associated in 1907 with the Bay Cities Home Telephone Co. of San Francisco as superintendent of equipment and later with the Pacific State T. and T. Co., returning to Chicago in 1913.

As telephone engineer and technician alone, Mr. Baer won instant recognition wherever he went, but he also possessed a keen sense of commercial values which made his services invaluable whenever important negotiations were pending. Thus it was that, when, in 1913, the development of automatic telephone business with the Australian government required the presence of telephone experts in that country, Mr. Baer was chosen as resident engineer to represent the company. After his return in 1915, he was made resident engineer in connection with the automatic telephone installations in the Twin Cities, where he added to his already large circle of friends.

Returning to Chicago at a time when the greatly increased business of the company required extensive additions to its engineering and production facilities, he was appointed contract sales engineer, later becoming assistant chief engineer. His more recent appointment as commercial manager was an added tribute to his ability as engineer and executive.

Mr. Baer's experience during the last twenty-four years, covering every phase of automatic telephone engineering and operation, enabled him to bring to his work exceptional qualifications of knowledge and personality. He had become widely known in the telephone profession, both because of his numerous commercial and personal contacts and also through his contributions to the literature on automatic telephony in the form of monographs and technical papers presented before engineering societies. His loss is keenly felt, both by the company, to whose interests he devoted so much time and energy, and by the scores of telephone operating companies who learned to appreciate the value of his counsel.

Mr. Baer is survived by Mrs. Anna J. Baer and two sons, Fred M. and Robert L. Funeral services were held on Friday morning, September 9, at St. Francis Xavier's church, La Grange, Ill. Interment was at Mount Carmel cemetery.

Illinois Meets November 17 and 18, Springfield

Springfield, Ill.—Dates for the "Service Convention" of the Illinois Telephone Association have been definitely arranged with the Hotel Abraham Lincoln. The convention will be held on November 17th and 18th at the Hotel Abraham Lincoln, Springfield.

Salina, Kan.—Public Utility Investment Co. has bought telephone properties at Crescent and Lovell, Okla.

How to Read Telephone Circuit Diagrams

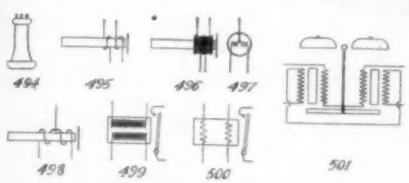
By DAVID S. HULFISH

CHAPTER VIII

(Copyright, 1927)

Where current through one winding is required to neutralize the inductive effect of current through another winding, the two windings usually are shown nearly equal in appearance. A few symbols for differential units of apparatus are shown in Figs. 494 to 501, inclusive.

Fig. 494 indicates by the three terminals at the top of the receiver that there are two windings, one terminal being common to the two; whether the coils are differential upon each other at all times, or under certain conditions, the diagram reader is left to surmise. In Figs. 495 and 498, the inductive relation is shown by the direction in which the



Figs. 494 to 501. Symbols for Inductances Differentially Related.

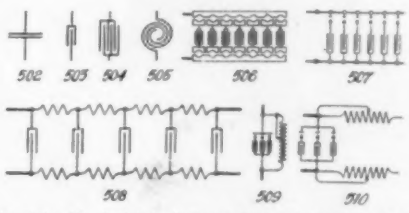
wires pass around the core. In Figs. 496 and 497 the direction of the turns around the core must be assumed or gleaned elsewhere in the diagram.

Figs. 499 and 500 show differential relays. Are these symbols representative of relays with a repeating-coil function? The diagram in which the symbol was found must answer the question.

Fig. 501 represents a polarized telephone call bell, each of the magnet spools of which is double-wound. Taking the upper wire, the circuit progresses downward along the left-hand core and upward along the right-hand core. Taking the lower wire, the circuit progresses upward along the left-hand core and then downward along the right-hand core. With current passing from left to right along both of the wires of the symbol the magnetic polarity produced by each winding in either core will be opposing that produced by the remaining winding of that core.

The ringer of the symbol of Fig. 501 therefore is differential and unresponsive when equal currents pass from left to right along both of the wires of the symbol; but when either wire carries a current and the other wire does not, the ringer will be responsive, and when the two wires carry currents which flow in opposite directions as they traverse the symbol the effect will be cumulative and each current will strengthen the effect of the other.

Simple condensers, the symbol of electrostatic capacity, are typified in Figs. 502 to 505, inclusive. The symbol of Fig.



Figs. 502 to 510. Symbols for Condensers, Simple and Adjustable, and for the Artificial Line.

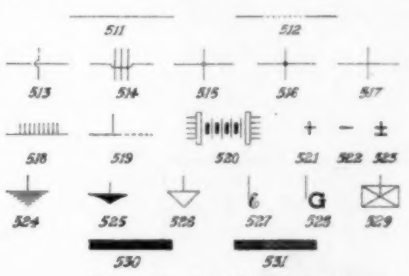
505 manifestly is drawn to represent a rolled condenser.

Relative dimension of condensers is shown in the comparison of the symbols of Figs. 503 and 504; more leaves, rather than a longer leaf, is the key to the distinction. Adjustable condensers are shown in Figs. 506 and 507.

An electric line of metallic circuit and having the features of distributed resistance and distributed capacity is symbolized in Fig. 508. Such a symbol is the symbol of an artificial line.

Figs. 509 and 510 also show symbols for an adjustable artificial line.

The symbol for an artificial line will be encountered in circuits wherein differential or balanced apparatus is included and wherein it is necessary that some local circuit carry a current at all



Figs. 511 to 531. Symbols for Conductors.

times equal to the current passing over the transmission line. In such an instance, an artificial line, preferably adjustable in the symbol, is included in the local circuit, and this artificial line is adjusted to have approximately the same resistance and capacity as the physical line over which the transmission is being effected.

In its simplest form, the symbol for the artificial line becomes merely a resistance symbol and a condenser symbol in parallel.

An electrical conductor is represented in a diagram usually by an unbroken line joining the points of apparatus between which the conductor extends. See Fig. 511. This symbol for representing a conductor does not suggest the material from which the conductor is made, nor

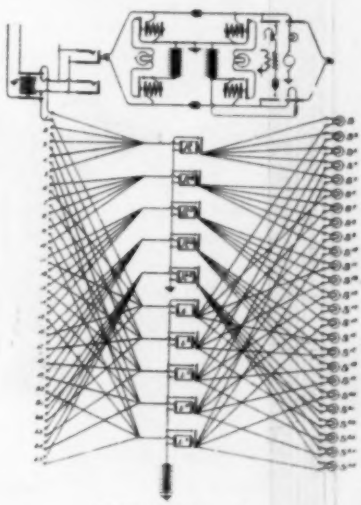


Fig. 532. Conductors in Mass.

the distance between the points represented at the ends of the conductor.

A conductor seemingly very short in a diagram may be of considerable length when the wiring of the actual apparatus is studied. To suggest length, the symbol of Fig. 511 is modified as shown in Fig. 512, wherein the dotted portion of the line indicates distance. Such a broken portion usually is found in conductors leading from a central office to a substation, or in conductors leading from symbols for equipment located in one central office to symbols for apparatus located in another central office.

As conductors are drawn in a diagram, it becomes necessary to cross them in many places; hence a convention has been adopted to indicate that two wires which cross are not connected electrically. This convention is the half-circle jump of Fig. 513. When a group of wires is to be crossed, the jumping wire sometimes is drawn in a single displacement to cross all of the group, as shown in Fig. 514.

When conductors are electrically joined, a small circle or a solid black dot

The Monarch supervisory signal and key has the two clearing out signals, the ringing and listening key and the ring back key combined in a single unit.

Your Pr

KEY shelf
is fast be
tion. The
acquired with
provides opera
of common b
ible from any
ment in direc
Clearing out
—These and
reasons why
ping their pr
supervision.

Your present
equipped with th
very little expen
life of your preser

*Our sa
change
superv*

"For Greater Servi

Monarch

Telephone Equipment

American Ele

State an
Chica

Succes
Monarch Tele

American

Branch Office and Warehouse: 7

is used; this might be thought of as the symbol for a soldered joint. A branching wire, as in Fig. 519, is clearly a case of electrical joining; the dot or circle symbol of Fig. 515 or 516 usually is used, and is not out of place.

Where wires cross without any indication, the diagram must be studied to determine the draftsman's rule. Perhaps he is using the symbol of Fig. 513 but not of Figs. 515 and 516; perhaps he is using a symbol of Figs. 515 or 516 but not that of Fig. 513. (See Fig. 532.)

A wire which branches to many points is called a 'bus wire, an abbreviation of "omnibus" wire, or wire for all purposes. The symbolization of such wires is shown in Figs. 518 to 529.

In lieu the symbol of Fig. 520, or in any source of current or constant potential, the 'bus wires or 'bus bars connecting to either terminal may be indicated by the sign indicating the polarity of the terminal to which they connect. Thus, in a diagram where a battery and a ringing generator is shown, the symbol of 521 adjacent to the terminal of a wire indicates that the wire extends to the positive terminal of the battery; that is, the symbol of Fig. 521 may be interpreted as a symbol for a 'bus conductor. Likewise, the symbol of Fig. 522 is the symbol of the 'bus conductor connected to the negative terminal of the battery, and the symbol of Fig. 523 is the symbol of the 'bus wire of the alternating-current source, or ringing generator. The earth conductor is indicated by symbols in similar manner, some of the symbols used being given in Figs. 524 to 529, inclusive.

Contrasting with the symbols for conducting mediums, the symbols of Figs. 530 and 531 are for insulating mediums.

Fig. 532 is a figure selected to show the crossing of conductors in a diagram. In the upper portion of the figure, there are several instances where one conductor crosses another without contact, and the convention of Fig. 513 is observed. In the lower portion of the figure, however, the crossing conductors form such a maze that the use of the same convention would only render the conductors more difficult to trace; hence it is abandoned and the lines are drawn straight.

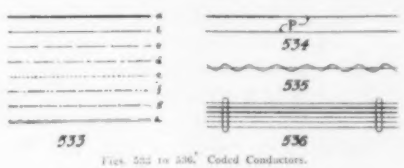
The "coding" of conductors in a circuit diagram consists of specific modification of the conductor symbol to indicate the purpose for which the conductor is used. Figs. 533 to 536 show some codes which have been used.

Most widely used of all coded conductors is the heavy conductor for the "talking pair"; that is, for the wires which carry the speech currents of a telephone conversation. This is seen in Figs. 548 and 549. By this distinction, it is easy to follow the "talking circuit" through the diagram, and to recognize it whenever any signal wire is traced into operating relation to it. The same principle is extended to other wires, particularly in wiring diagrams.

Fig. 533 shows a code of conductors to illustrate the principle, extended to conductors of several classes. While the different line values may be assigned to different classes, arbitrarily, the following list will be typical:

a—Conductors carrying speech currents of conversations between subscribers.

b—Conductors carrying signaling currents individual to a specific signal device.



Figs. 533 to 536. Coded Conductors.

c—Battery 'bus, live side or ungrounded side.

d—Battery 'bus, grounded side of battery.

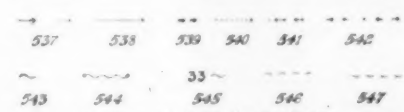
e—Alternating-current, ringing leads, 'bus wires.

f—Signaling circuit, common to more than one signal.

g—Interrupted current, or pulsating current 'bus wires.

h—A derived circuit upon the speech conductors.

The above line values and their code as given are observed in Fig. 549. The code for the calling plug's equipment



Symbols Indicating Currents.

sometimes differs from the code for the answering plug's corresponding equipment.

Fig. 534 shows the symbol for a twisted pair; the two wires indicated by the *P* are twisted together either in a single duplex wire or in cables. *T* may be found instead of *P* or sometimes *TP*. The symbol of Fig. 535 also indicates that the two conductors are a twisted pair and insulated from each other.

In Fig. 536 the symbol is the loop surrounding the group of parallel conductors. This indicates that the conductors enclosed within the loop form a cable in the wiring of the apparatus.

A flow of current, without any showing of the absolute value of the current, has been indicated by arrows placed near the conductor. For discrimination between currents, either simultaneous or at different times, the arrows vary in size and shape. Arrows for alternating currents either point in both directions or are curved.

Figs. 537 to 540 are symbols indicating that direct current flows in an adjacent conductor. Figs. 541 to 545 are symbols for alternating current in an adjacent conductor. The arrow points are omitted from the symbol of Fig. 543, and in Fig. 545 the frequency is indicated by the figures, the current value being not shown. Speech currents are indicated by the alternating current symbols. Figs 546 and 547 are suggested symbols for pulsating current, positive and negative, respectively.

(To be continued.)

Prevent Loss of Entire Leon (Ia.) Plant by Fire

Leon, Ia.—August 24 the Middle States Utilities Co., suffered a fire loss in its storeroom at Leon. Several thousand dollars worth of telephones, switchboards and kindred equipment was damaged by fire, water and smoke. The fire started in the refinishing department where some 400 telephones were in the process of being refinished. The prompt response and efficient work of the local fire department saved the entire loss of material and building. Had the building burned it would have been almost impossible to save the telephone office building, as the city water pumps were in an adjoining building and the fire would probably have put the pumps out of commission.

M. L. Golladay of Holden, Mo., is general manager of the company.

Silvray Announces New Distributors

New York City—The Silvray Co., Inc., 55 West 16th street, manufacturers of the Silvray System of Indirect Illumination announces the appointment of the Silverlite Co., 150 Post street, San Francisco, as its distributor in the California territory. The company also announces that Silvray products are being handled in the Pittsburgh district by the Silvray Co., of Pittsburgh, 211 Renshaw building, and in the Philadelphia territory by the Philadelphia Daylight Co., Bourse building, Philadelphia.

Prominent among the new products brought out by the company is their "Spraylite" lamp. This is a standard lamp having a permanent reflector silvered directly upon it in such manner as to efficiently control the direction of light rays coming from the filament. With this lamp it is claimed that an increase up to 33⅓ per cent of light delivered on the working plane can be obtained; or an equal quantity of light from a lamp of lower wattage.

Studying Details of Telephone Work

By E. R. COLLINS
Manitoba Telephone System

CHAPTER VIII

In the preceding articles, we have been studying something about the different materials, used in connection with telephone apparatus. We will now turn our attention to some of the specific uses for the apparatus studied. It is hoped that where classes have been formed, the experiments will be carried out.

Early telephones were made up of such pieces of equipment as the transmitter, induction coil, receiver, bell, generator, batteries and sometimes a box to place them in. It was part of the installer's work to assemble these parts on a blackboard or table, or other convenient place, and wire them up to operate as a telephone. These different parts were called a set of parts. This term has gradually changed, till today we call a subscriber's telephone a sub-set. The telephone of today comes fully assembled. So much for the name.

The writer remembers well a good joke on himself some years ago. I was sent to install three desk telephones in a fine residence, and one of the sets was to be placed on a small oak table. With great labor I fastened the bell and generator, and induction coil and connecting block under the table and made a fairly neat job wiring it. Just as I was about finished the Lady of the house came along and asked why I didn't turn the table upside down and do my work. Of course all I could do was to look foolish, and make some outlandish excuse. However, installing a desk telephone in those days was not the easiest job.

The Magneto Telephone

While the magneto telephone is by no means the most simple type of sub-set, it is generally used for farm or rural lines, and for small telephone exchange systems. The magneto set was the first type developed for general commercial service. It is often called a local battery set, because the batteries for the transmitter are included in the set. Two magneto telephones connected to a line wire can be used as a complete system of communication between two points. Several magneto telephones can be connected to a party line, to form a complete system of communication.

The Hook Switch

In every telephone there is a piece of apparatus known as the hook switch. The name is no doubt chosen because the arm which operates the switch has a hook which holds the receiver when not in use. There are very many different types of hook switches, all based on the one principle. The arm with the hook is moved in an up and down motion. The upward motion is caused by the pressure of a heavy spring, and the downward motion is caused by gravity pulling the receiver down, when placed on the hook. It is therefore necessary for the receiver to be heavy enough to overcome the upward pressure of the spring. In some receivers this weight is supplied by a lead casting set in between the magnets of the receiver. The switch consists of a set of springs in which contacts of platinum or other suitable metal alloy are riveted. As the springs change position, they change the circuit arrangement of the telephone. If you will obtain a hook switch, you will observe that the contacts are set opposite each other in the springs. It is very necessary that this be so, or poor contact will result. There is also a slight wiping motion of the contacts against each other, due to the springs traveling in different arcs of a circle. There is also a spring travel which insures heavy contact. For instance, we will say that the heavy spring is moving to the left toward a lighter spring. The motion of the heavy spring must continue, at least a distance equal to the thickness of the spring, after it has actually touched the lighter spring. Thus it moves not only itself, but moves the lighter spring to the left, after it has made actual contact. This is a very important thing to remember in all work where spring combinations are used in telephone work.

The arm of the hook switch must have a free movement, to provide for the full travel of the spring assembly attached to it. A receiver which is too light will not bring the arm down sufficiently to complete the spring travel, and will not leave the telephone circuits in the proper position. On the other hand a receiver which is too heavy will be very tiresome to the subscriber. (This might not be a bad feature on some telephones.)

The Hand Generator

The magneto telephone, as its name implies, is equipped with a magneto or hand generator. This generator supplies the alternating current necessary to ring the bells. Telephone generators are bipolar, having two poles, as described in Figs. 37 and 38 of previous issue. One revolution of the armature will give one complete cycle. Hence to generate a 20 cycle current, the armature must turn 20 times per second. If the gear wheels are geared 4 to 1 ratio, one turn of the crank will cause 4 revolutions of the armature. Therefore a 20 cycle current requires 5 revolutions of the crank per second. If the speed of the generator is increased, the voltage will also increase, but so will the frequency. If the bells are designed to ring at maximum efficiency at 20 cycles, increasing the frequency of the generator will decrease the efficiency of the bells. The impedance of the bell coils will rise quickly with increasing frequency of the ringing current, and will offset the increase in voltage. The pendulum of the bell has its own natural period of vibration, which for a 20 cycle bell will be 20 times per second. The pendulum will therefore lag behind the frequency of the ringing current if it is too high. Therefore the best average speed is worked out by the manufacturer in building his generators.

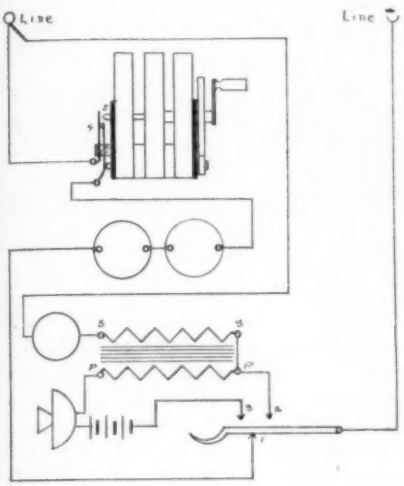
Magneto Shunt Springs

A very important part of a magneto generator used in telephones is the shunt spring assembly. On the left side of the generator is usually found a set of springs. These springs are moved by the main or crank shaft of the generator. Due to the construction of the crank shaft, which can best be studied by opening up a generator, the shaft extends to the left when the crank is turned. The armature of the generator will hold in a definite position due to the pull of the permanent magnet. The pressure required to overcome this pull is greater that the pressure of the spring in the crank shaft, so that if a directory is hung on the crank in certain positions it will hold the shaft extended. This in turn operates the shunt springs. The spring assembly will be different for different classes of service.

Series Magneto Telephone

In Fig. 52 is shown a circuit of a series telephone. The hook switch is shown

down so the arm is touching the lower contact. As the receiver is on the hook when not in use, this will be the normal position of the switch. Therefore we call contact (1) the normal contact. This is also referred to as the break contact because it breaks when the switch is not



Series Magneto Telephone

Fig. 52

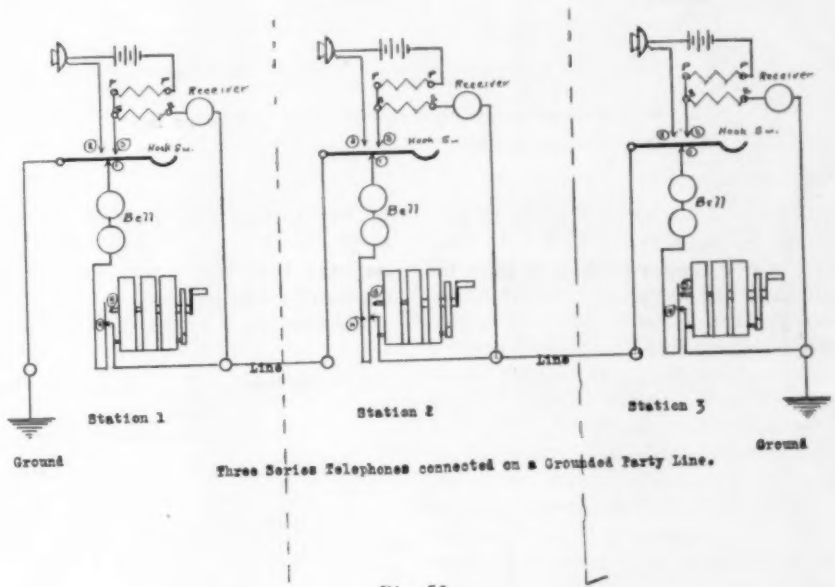
normal. When the receiver is removed from the hook, the arm makes contact at 2 and 3. Therefore we call 2 and 3 make contacts.

The generator in Fig. 52 is not in use, therefore the springs are in their normal position. In this assembly the normal contact is (4). When the crank is turned, the shaft operates the springs, making contact at (5). We have here a condition different to contacts (1-2-3) because (5) makes before (4) breaks. This type of a spring assembly we call a make before break spring assembly. As this type of assembly will be met with quite often, it is best to make a mental note of it here.

In Fig. 53 we show 3 telephones similar to Fig. 52, connected with a single line. The three telephones are in series, in that the ringing and talking current both travel through the three telephones and line sections. A break in the circuit in a telephone or the line will disable the whole circuit. The earth is used for a return path for the current flowing. We have shown the telephones as stations 1-2-3. The receivers are off at Stations 1 and 3, and on at 2. Sections of line (A) and (B) connect the telephones with the earth return taken at stations 1 and 3. Note the conventional marking for a ground connection.

The transmitter and battery and primary of the induction coil are connected in a local circuit. None of the battery current travels over the line. The induced currents set up in induction coils at Station 1 or 3, flow from, say, primary of induction coil at station 1 through receiver at station 1 line section hook switch, station 2, contact (1), through ringer coils, normal contact (4) of generator, section of line hook switch contact (3) at station 3, secondary of induction coil at station (3), receiver at station 3, to ground, back to the hook at station (1), contact 3 to secondary of induction coil at station (1).

If the bell at station (2) were a 38 A ringer, with 1,000 ohms resistance and 3.2 henrys inductance, at 1,000 cycles frequency, the voice currents would find an impedance of about 20,000 ohms. This would be equivalent to over 600 miles of No. 12 iron wire at 33 ohms per mile resistance. However in series telephone bells the wire resistance is usually about



Three Series Telephones connected on a Grounded Party Line.

Fig. 53

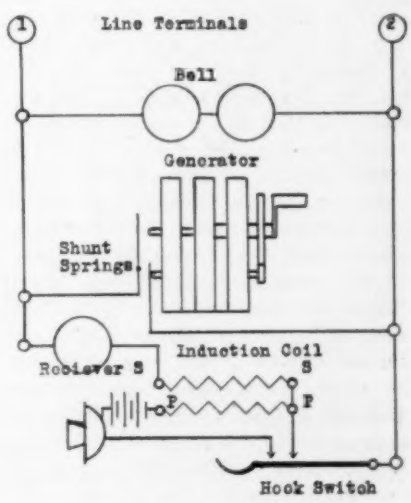
80 ohms, and the cores of the magnets are made much shorter. Therefore the effective resistance to voice frequencies would not be as strong as stated, but is still too high to permit very many telephones to be connected to a party line without impairing the transmission of the voice currents. The receiver coils are about 80 ohms resistance, but have a very small amount of iron in the core of the coil, and consequently very low impedance to voice frequencies.

We will suppose that the generator shunt springs at station (2) were operated due to the crank being stuck. The resistance of such a generator would be about 650 ohms, and due to the large amount of iron, the inductance will be quite large. Therefore the impedance of the generator in series with the talking circuit would cut down the loudness of the voice.

Generator cranks will stick if the shaft mechanism is not oiled and working free. The escutcheon place around the crank, if not set properly, will also cause the crank to bind, and hold the springs separated.

Bridging Telephone

In Fig. 54 we show the circuit arrangement of a typical bridging telephone. Here we find the bell, the generator and the talking circuit connected across the line as three separate units. They are bridged across the line. The bell is, say, 1,000 ohms, a 38 A ringer such as we have been studying. This we know will offer a high impedance to voice currents, about 20,000 ohms. So very little of the voice current will pass through the ringers. The generator shunt spring has simply a make contact, which connects it across the line only when the crank is being turned. The induction

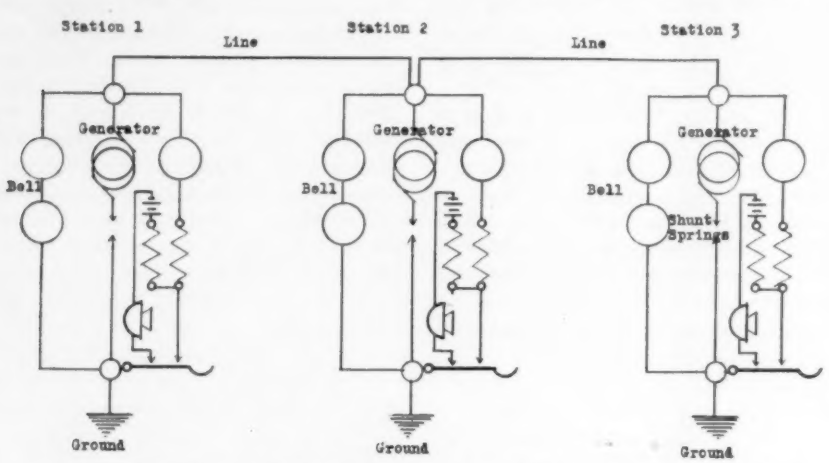


Bridging Magneto Telephone Circuit.

Fig. 54

coil, with the transmitter and receiver, are connected to the line with the hook

switch. There is no normal contact to cause trouble. The hook switch is therefore simple. Since the bell coils are always connected to the line, there is less danger of failure to ring when called from an outside point.



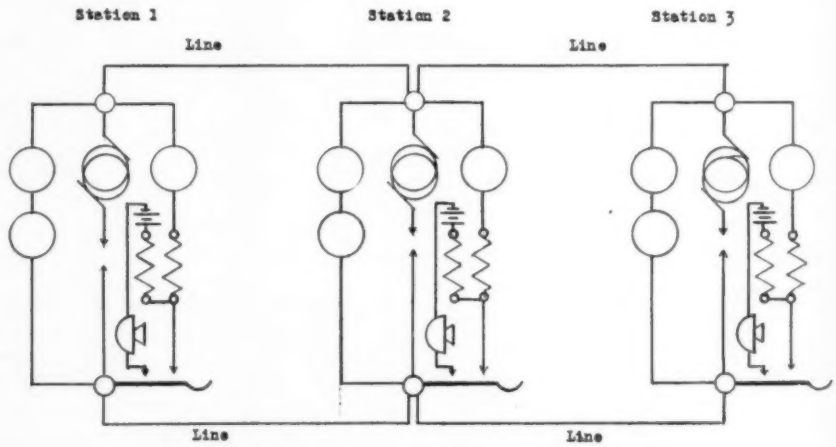
Three Bridging Magneto Telephones connected to a Single or Grounded Party Line.

Fig. 55

In Fig. 55 we show 3 bridging telephones connected to a grounded line. We have used a simpler marking to show the generator and its springs. The transmission on such a line is good, but is subject to interference from power lines, or street railway lines. In isolated places away from power interference, a single or grounded party line is very economical. The general method in use today, however, is the metallic circuit, where the earth connection is replaced by another wire. The reasons for the improvement in transmission with a metallic circuit will be considered in another chapter.

With the bridging party line as shown in Fig. 56 let us consider the effect of a shunt sticking at Station (2) while (1) and (3) are talking. The generator coil at Station (2) would be connected across the line. The resistance of a 5 bar generator as used in a modern telephone would be about 250 ohms. Due to the larger amount of iron, the inductance would be greater, giving a high impedance to voice currents. The effect on the conversation would therefore be very slight. Suppose Station (1) was ringing Station (3) with the shunt stuck at Station (2). The impedance to 20 cycle current offered by the generator would be much lower. The wire resistance would be 250 ohms, and the effective impedance would not be much higher than this. A large portion of the current generated at Station (1) would pass through the generator at Station (2), leaving very little current to ring the bell at Station (3).

The effect of leaving the receiver off the hook at Station (2) when Station (1) is ringing would be very bad. This would place the receiver and secondary of the induction coil across the line. Due to the low impedance of the receiver and induction coil, the effective resistance to 20 cycles would be about 120 ohms. This path would therefore shunt most of the ringing current causing the bells on the line to ring very poorly. In early party line sets, this condition was very annoying, especially on a new line where the novelty had not worn off. Let the troubleman start testing his bells, and off came the receivers, and he was stuck till they were hung up again.



Three Bridging Magneto Telephones connected to a Metallic Party Line.

Fig. 56

In Fig. 57 we show the same arrangement as in Fig. 56 only we have added a ½ M. F. condenser in series with the receiver and induction coil. In Chapter 6 we learned that the unit of capacity is the farad, and that commercial telephone condensers are made up in units of so many microfarads. Now the microfarad is one-millionth of a farad. So in all our calculations relative to telephone condensers the figure 1,000,000 will have to be taken into consideration. To find the reactance or impedance of a condenser, we must know the capacity and also the frequency of the current, and a fixed quantity 6.28.

To find the reactance of a 1 M. F. condenser, to 1,000 cycles, divide 1,000,000 by the product of frequency × capacity × 6.28 or $1{,}000 \times 1 \times 6.28 = 159$ ohms.

A ½ M. F. condenser at 1,000 cycles would be: 1,000,000 divided by $1{,}000 \times \frac{1}{2} \times 6.28$ or $1{,}000 \times .5 \times 6.26$.

Multiply the three quantities together, ignoring the decimals, and then strike off the last three figures from the right of the product. Then divide this amount into the 1,000,000, and you have your answer, which is 318 ohms.

A 2 M. F. condenser at 20 cycles would be:

$$\frac{1{,}000{,}000}{20 \times 2 \times 6.28} = 3{,}980 \text{ ohms.}$$

A ½ M. F. condenser to 20 cycles would be about 16,000 ohms. Therefore if the receiver is left off with the condenser as shown in Fig. 57 there would be a resistance of about 16,000 ohms offered to oppose the flow of the 20 cycle ringing current. Therefore leaving the receiver off the hook at Station (3) would have practically no effect on the ringing of the other bells on the line.

The impedance of this condenser to voice frequencies would be very slight, since a ½ M. F. condenser offers to 1,000 cycles only 318 ohms. Then if we refer back to the chaper on inductance, we find that the condenser and inductance in series caused the 100 watt lamp to burn again. Therefore we can expect that with the capacity of the condenser and the inductance of the receiver and induction coil in series, will reduce the effective resistance of this circuit arrangement to the voice frequencies.

The Magneto Exchange

Magneto telephones of the series type are still used for lines where only one telephone is connected to a line to an exchange. The bridging telephone is

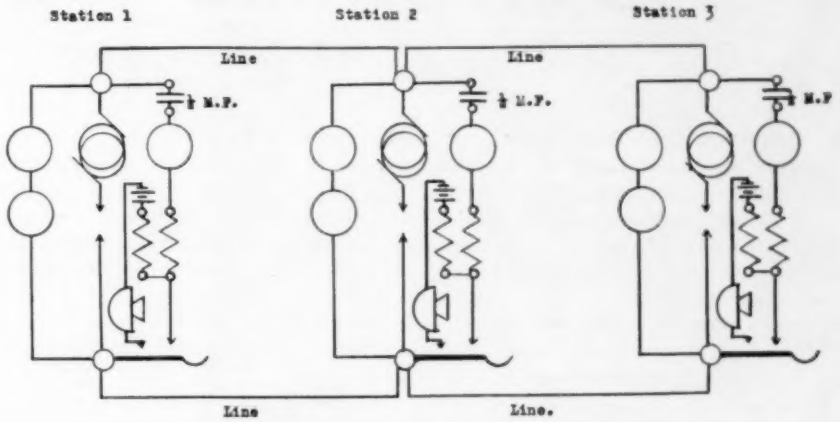
also used for this purpose. Where only one telephone is connected to a line, and the turning of the generator needs only to generate current for the signal in the exchange, a 3 bar generator is used. On heavy party lines, where there are several bells which must be operated, a 5 bar generator is used. The 3 bar type are usually wound with a finer wire, of about 600 ohms resistance. The increased number of turns make up for the weaker magnetic field. The amperage of such a generator will not be very large. The generator of the 5 bar type is wound with coarser wire. Due to the stronger field, the smaller number of turns will generate a current of heavier amperage, and yet give a voltage as high as the 3 bar. This provides a greater body of current to ring the bells of the rural line.

Lines which are connected to a switchboard of a telephone exchange terminate in a jack. Switchboard jacks are made in a great many designs. Fig. 58 shows an example of the method used to connect a telephone to the jack. In this case a bell is shown connected to the line. When the operator puts the plug into the jack, the bell is disconnected from one side of the line. This prevents the shunting of voice currents through the bell. In this Fig. 58 the telephone is shown on a grounded line. It was quite common to have a common ground at the central exchange connected to the switchboard jack as shown. In Fig. 59 is shown a condition, which was quite common at one time. Here we have telephone stations, "A," "B," "C," "D" and "M" all connected to an exchange "E," using the common ground connection. We will suppose that the ground at "E" is broken at X or dried out. Now if Station "A" rings, the ringing current will be seeking a ground to return to its course. But ground at "E" is broken. Then we find the current spreads and will return through the bells in the exchange and over the lines, through the bells at the several telephones, to ground, and back to "A." Thus any one telephone will ring any other telephone.

The path of the voice currents will be the same, only the loudness with which the voice can be heard on the different lines will depend largely on the impedance of the bells through which it passes.

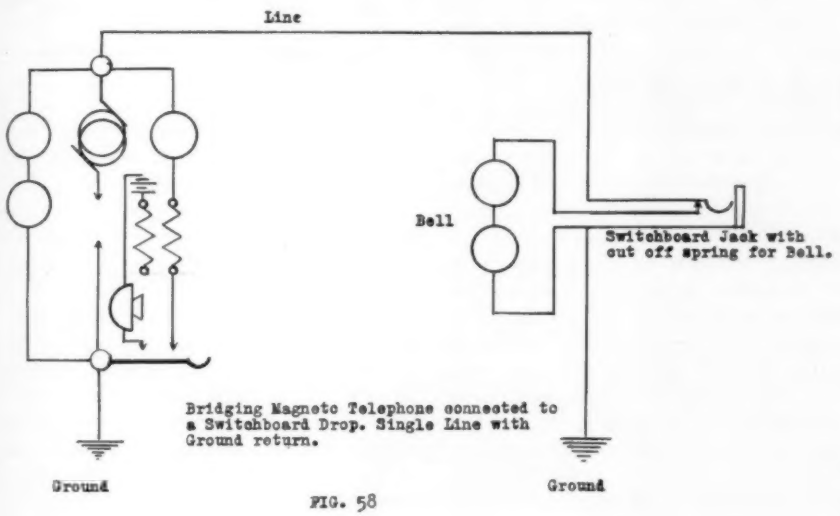
The writer once had occasion to visit an exchange where there were 22 rural grounded lines, terminating on one exchange in a country grocery store. Each line had an extension bell for a signal. The bells were all arranged in a row on the wall. To the clapper of each bell was tied a price tag, and the operator could tell the line by the wiggling tag. However, the bells were all ringing together, and had been for several days. We found the ground, a piece of galvanized iron, connected with iron wire to the switchboard, had been rusted away. A new ground was put in and the trouble ceased.

In our next chapter, we will take up the different types of circuits used in connection with magneto exchanges.



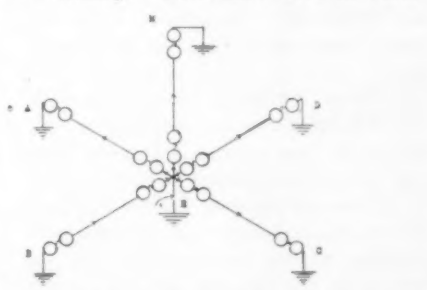
Three Bridging Magneto Telephones connected to Metallic Party Line.
¼ M.F. Condensers connected in series with Reciever Circuit.

Fig. 57



Bridging Magneto Telephone connected to a Switchboard Drop. Single Line with Ground return.

FIG. 58



Five Single Magneto Lines connected to Exchange using Common Ground. Exchange ground broken at "E"

Fig. 59

Boosts Diamond Hammer Drive Anchorage

Garwood, N. J.—Diamond Expansion Bolt Co. recently has issued an interesting booklet on the Diamond hammer drive anchors for making quick fastenings to brick, stone or concrete. Details of the anchor, which is galvanized zinc of sufficient tensile strength to supply high holding power, are given in the booklet, together with data on its holding power and method of installation.

Bethel, Vt.—White River Valley Telephone Company is credited by Post Post with having "prettiest telephone office in all New England . . . in perfect harmony with its background of river and mountains."

Washburn, N. D.—Jens Odegard, owner of the Washburn Telephone Co., has bought Beulah Telephone Co.

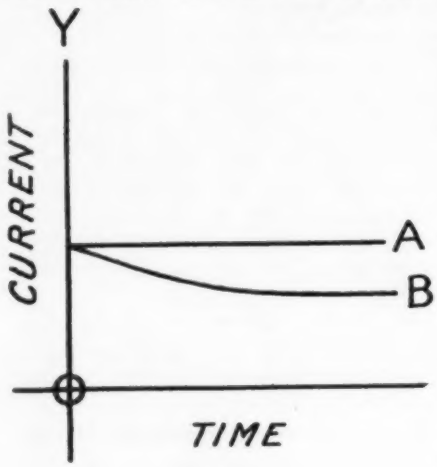
Chicago, Ill.—Proceedings of the eleventh annual convention of the U. S. I. T. A. held at Chicago, October 12-15, 1926, have been printed and released for record purposes by the Independent association.

Alternating Currents in Telephone Practice*

By F. J. DOMMERQUE
Fellow A. I. E. E.

80. Deduction of Sine Law for Current and Electromotive Force.

In the previous discussions only direct or continuous currents had been used, which retained a constant flow in one direction, as long as the resistance of the circuit remained the same. Such a current can be represented by a straight line as is marked A in Fig. 87, where the time is plotted along the X-axis in seconds, minutes, hours or days, and the current along the Y-axis in amperes.

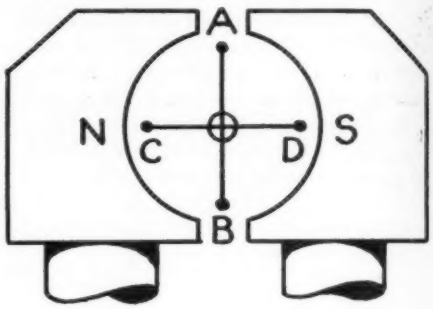


This line A has the same ordinate only as long as the e. m. f. remains constant. In actual practice this is usually not the case when a battery (primary or secondary) is employed as source of current; the e. m. f. or the voltage drops slightly but gradually as indicated by the curve B, until the battery is run down to to a point, where it has to be renewed or recharged as the case may be. In either case there is a continuous flow of the current in one and the same direction.

It is different with alternating currents. Alternating currents are produced by a machine under conditions which will be explained in a general way. When speaking of the Problem of Telephone Physics we said in section 16 that "Telephonic transmission is a problem of wave propagation. All electromagnetic waves are alternating current waves, therefore the study of the transmission problem consists in the first instance in the examination of the influences exerted by certain phenomena upon the propagation of the alternating current waves over the line." The discussion of alternating currents which is to follow will not go deeply into the subject as it would require the application of higher mathematics than could be assimilated by the average telephone man, but nevertheless the elementary explanations we are going to make will give to the reader a fair conception of the telephone transmission problem and the phenomena accompanying it.

Any motion of a conductor forming a closed circuit or constituting part of one in a magnetic field creates a current in the conductor. In order to render this current useful, means must be provided not only to convey the current to a place where it can be utilized, but also to generate as much of it as possible under given circumstances. A contrivance to answer the latter purpose is the armature of a dynamo. It is mechanically difficult to repeat a to-and-fro motion of a conductor in a magnetic field in short intervals of time; the same result is obtained by rotating the conductor around an axis, and as two conductors can generate twice as much energy as one, the space on the armature between the poles of the magnet is filled up with conductors to the greatest extent. The current that flows in the conductor is due to the e. m. f. set up in the conductor at the point where the same moves in the magnetic field. The e. m. f. is the result of the conductor cutting the lines of force that find their way from magnet pole to magnet pole bridging the intervening air gap and thus close in upon themselves. The passing of these lines is facilitated by filling the space left between the poles with iron; practically this is accomplished by winding the conductors around an iron core.

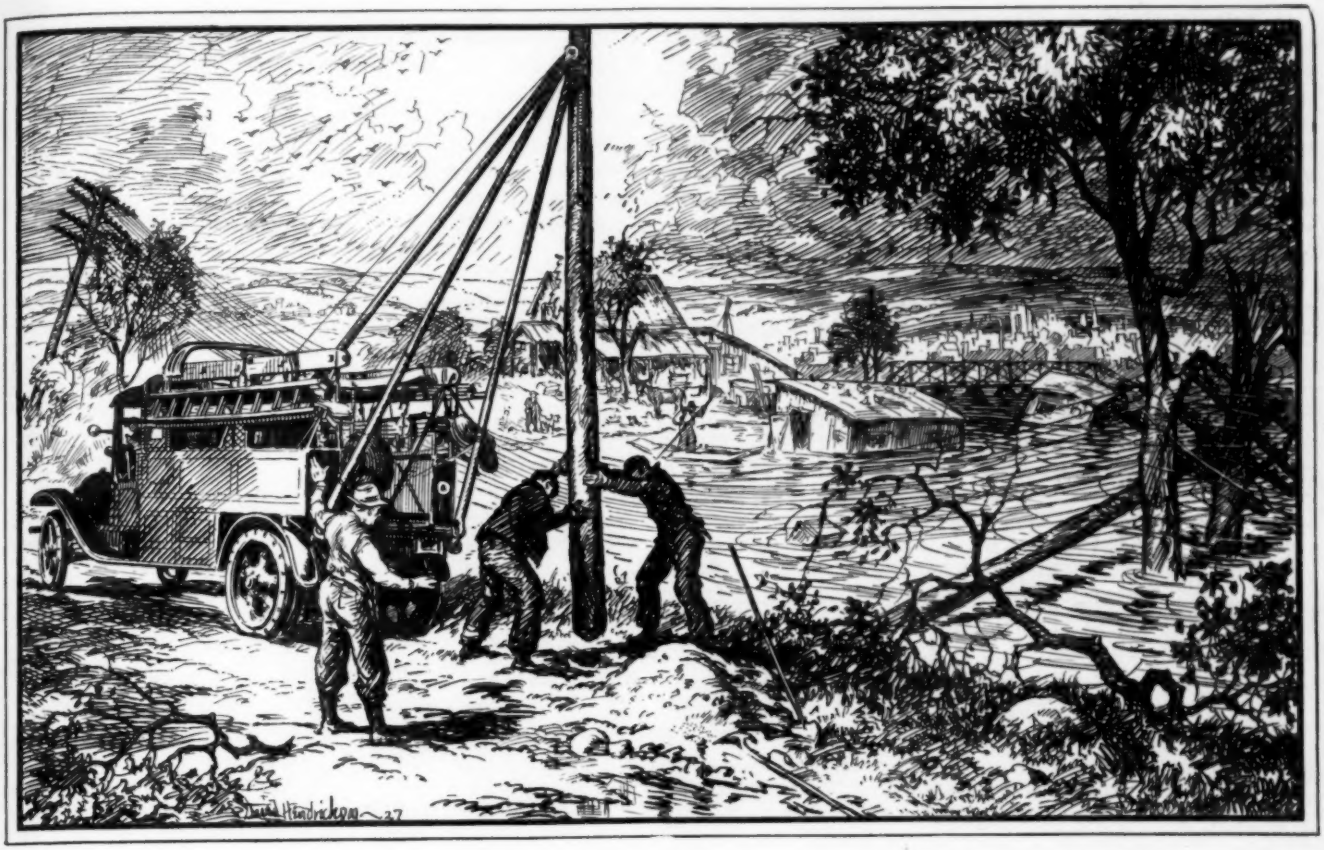
When a conductor bent into a rectangle rotates around an axis, sweeping past the pole faces of the magnet, it cuts these lines of force at a greater or less rate, according to its position at the instant of observation. In Fig. 88 the conductor is shown with O as axis of rotation. When the conductor is in the position AB, that is, perpendicular to the path of the lines of force migrating from pole to pole, the greatest number of lines passes through the loop, but the loop does not cut any. Now revolve the loop until it comes to the position CD. On the journey to this position the loop begins to cut lines as soon as it leaves AB, and the *rate* of cutting increases in moving toward CD; when it is in CD the rate of cutting is highest. By passing CD and going on to the position BA, it keeps on cutting, but the rate decreases until, at BA, the number of lines cut again equals zero. This cutting of lines effects the generation of e. m. f. The amount of e. m. f. set up is proportional to the rate of cutting lines (Faraday's law). Now, neglecting all disturbing factors such as hysterisis, inductance, etc., and assuming the loop to move in a uniform magnetic



field with uniform velocity, we may let the loop rotate around O and consider only the one-half of it at the time, for the other half goes through the same proceedings, only in reversed direction. Thus, when the one-half cuts N lines, we say the other half cut — N lines.

Looking along the conductor as it is represented in Fig. 88, that part of it which sweeps past the polepieces appears as a point (it really is the cross-section of the wire), and this point, when revolving, moves along the periphery of a circle. The revolving motion is caused by some force applied to the shaft of the dynamo. If no force were acting, the loop would assume one fixed position, namely that position where it is in equilibrium, and stay there. As soon as the force is applied the loop is forced out of this position of equilibrium, and if the force applied remains uniform the point will gain in velocity while moving along; it will be accelerated until the friction in the bearings and other physical resistances balance the accelerating force; we have then, by application of force, a constant speed, and we will also have the same e. m. f. and the same current once during each revolution for every point on the circle described by the conductor. The change of e. m. f. or of current during the motion of the conductor from point to point in the circle will be determined as follows:

*18th article on Telephone Mathematics and Physics.



All for One

An Advertisement of
the American Telephone and Telegraph Company

A SLEET storm descends, carrying down trees and wires. A wind turns outlaw and blows down a pole line. Or some swollen river rampages through a circuit of destruction.

But wherever angry nature attacks the Bell Telephone System there are repairmen trained to meet the emergency, and everywhere trained in the same schools to the use of the same efficient tools. Supplies of surplus equipment and materials are kept at strategic points whence they may be rushed by train or truck to the devastated area.

Throughout the Bell System, all construction and practice are standard, so that men and supplies, when necessary, may be sent from one state or company to another.

There are twenty-five Bell Companies, but only one Bell System—and but one Bell aim and ideal; stated by President Walter S. Gifford as:

"A telephone service for this nation, so far as humanly possible free from imperfections, errors and delays, and enabling anyone anywhere at any time to pick up a telephone and talk to anyone else anywhere else in this country, clearly, quickly and at a reasonable cost."

If N is the number of lines of force or the magnetic flux in Fig. 88, then the e. m. f. depends at any instant upon the time rate of change of the measure of N at that instant. Let the circle drawn in Fig. 89 represent the path of the revolving loop or rather of the one-half of it, then when the loop starts to revolve from point D in the direction indicated by the arrow, no lines of force will pass through it. After it has moved through an angle of 90° and has arrived at point A, N lines will pass through it. At point 1, when the loop has passed through an angle θ_1, the measure of lines is given by the ratio $\frac{01^\circ}{01}$ times N or N cos θ_1. At point 2 by the ratio $\frac{\theta 1_2}{\theta 2}$ times N or N cos θ_2 and so on. Thus we obtain as a measure of lines the expression N cos θ.

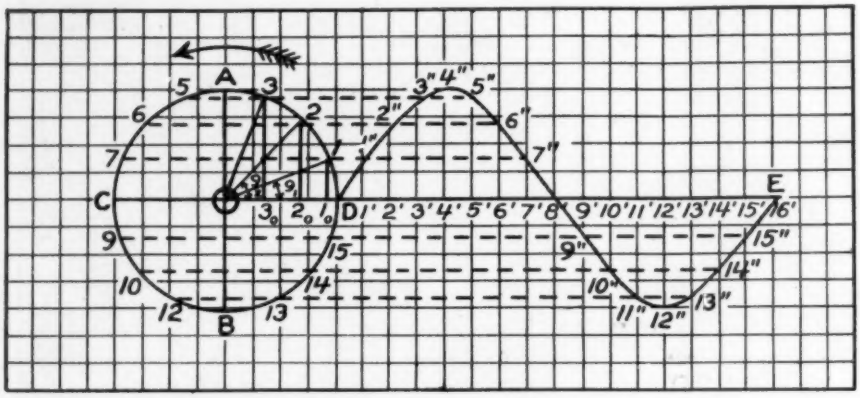


Fig. 89

With the e. m. f. it is different. When the loop starts at D it cuts the maximum number of lines of force and by the time it arrives at A it does not cut any. Therefore the e. m. f. is offset from the measure of lines by 90°. This means when the expression for the measure of lines is N cos θ, the expression for the e. m. f. is N sin θ. Current and e. m. f. are proportional, that is, the voltage E between the two ends of a conductor and the current I in the conductor are proportional according to Ohm's law $I = \frac{E}{R}$. Therefore both can be represented by the same form as follows:

In Fig. 89 divide the circle into equal parts, say into 16, namely 1, 2, 3.....up to 16. Extend the diameter CD and divide the extension also into 16 parts, namely 1', 2', 3'.....up to 16'. In the point 1', 2', 3'.....erect perpendiculars and project the points 1, 2, 3.....until they intersect the corresponding perpendicular lines in the points 1", 2", 3".... Connect the points of intersection, which gives a curve which is called the "sine curve"; this curve represents the form of an alternating current with respect to time. It tells the same story as the circle. On the circle the time intervals are arcs, namely D-1, 1-2, 2-3, etc. In the curve the time intervals are on a straight horizontal line, namely D-1', 1'-2', 2'-3', etc. This line DE is the axis of abscissae in a system of rectangular co-ordinates. The ordinates give the successive values of current during one revolution of the half loop.

In the above method the sine curve has been constructed mathematically. It could have been determined experimentally. Let R in Fig. 90 represent a resistance

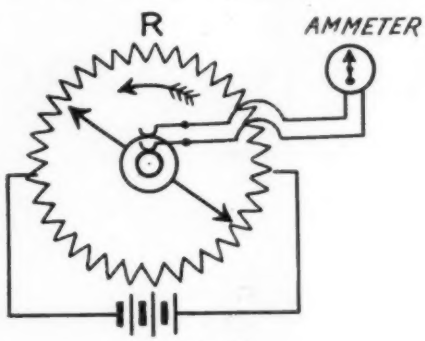


Fig. 90

wound in a circular coil closed upon itself. A battery may be connected at two oppositely located points. In the center of the coil is located a shaft which can be rotated by hand. This

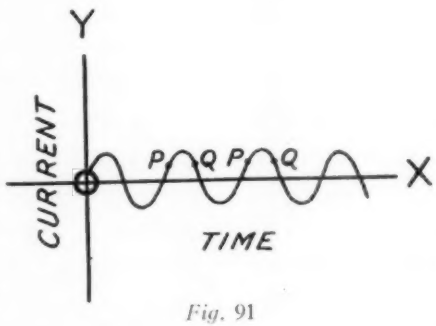


Fig. 91

shaft carries two collector rings, each one provided with a brush which sweeps over the convolutions of the resistance, the brushes being arranged diagonally opposite each other. Upon the collector rings rest two spring contacts which are connected to a hot wire ammeter or other ammeter suitable for measuring alternating current. If we turn the crank on the shaft slowly and with constant speed, the indicator upon the ammeter will change from one side to the other. When the two brushes are standing vertically, that is, at right angles to the battery connections, the indicator will be in the zero position, and when the brushes are in line horizontally with the battery connections to the coil, the ammeter indicator is farthest away from the zero position, to the left, or to the right, as the case may be. At the intermediate points the indications will correspond to the value of the sines given in table of trigonometric functions in section 27. Assuming the maximum value of the current as one ampere, this would correspond to the greatest deflection. The curve would start at O° at the point D, and as the brushes move around, it would move slowly to point 4", the highest point; in our division of the time into 16 parts, each part may, for example, mean 1/16 of a second; at this point the angle would be 90° and the value of the current 1 ampere. At point 2", corresponding to 45°, the value would be 0.7071 ampere, as seen from the table, and at point 1" it would correspond to 22½°, giving 0.393 ampere, while at point 3" it would correspond to 67½°, giving 0.923 ampere. After having reached the highest point, it would continue to point 8" on the decrease to zero and then reverse its direction, go to point 12" where it would be —1 ampere and continue to point 16", where it would be again zero. If the current at its maximum would have amounted to 10 amperes, the figures for the sines in our table would have to be multiplied by 10 to give the current at the different time intervals. This kind of determination of the sine curve is hard to accomplish, therefore we have given the mathematical deduction in preference.

81. Explanations and Definitions. At various occasions we have given brief explanation of some of the designations in use with alternating currents. In the section 13 on "Sound Waves," three simple waves were shown forming a complex wave; the three simple waves were designated as "harmonic" or "sine" curves. The three curves have the same form, but differ in "amplitude" and "number of vibrations." Then we defined *"amplitude"* as the distance of the highest point, that is, of the crest of the wave, from its axis, which divides each wave into two equal halves, one-half (positive) lying above the axis and the other succeeding half (negative) below the axis. It was further said that the crest and the trough, that is, the positive part of a wave, lying above the axis and the negative part lying below the axis, together, make one complete vibration.

Instead of the term vibration we will now introduce the word *"period"* of the alternating current. The current passes through a complete *"cycle"* of changes in one period.

In Fig. 87 the general flow of continuous current with respect to time was illustrated, Fig. 91 shows the changes in alternating current with advancing time. There are pictured a number of periods. Alternating currents alternate more or less rapidly. For instance, telephone, that is, talking currents, change from

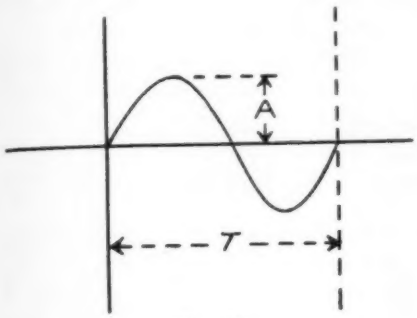


Fig. 92

300 to 3,000 times in a second; this is commonly expressed as telephone currents have a *"frequency"* of 300 to 3,000 periods per second or cycles per second. Hand generators have a frequency of 15 to 21 cycles per second, according to the gear ratio. High frequency currents as used in wireless telephony may reach a frequency of a million or more cycles per second.

In Fig. 92 a complete cycle is shown with the various designations marked on. The current passes through the complete changes from zero to maximum positive value back to zero, thence to maximum negative value and back to zero again during the period T. This period T comprises a "wave length" and is equal to the circumference of a circle or equal to 360° or 2π, if the radius of the circle is taken as 1. A is the "amplitude" of the curve and equals the maximum value of current.

As the frequency equals the number of periods per second, we can express the frequency n as $\frac{1}{T}$ or $T = \frac{1}{n}$. We furthermore have the relation $\frac{2\pi}{T} = w$ where w designates the periodic value of time or the angular velocity; w is also equal to $2\pi n$.

82. Phase Difference in Sine Waves. With the definitions developed in the preceding section the sine wave may be expressed by the equation $y = A \sin x$. Reverting again to section 13 on Sound Waves Fig. 10, showing the three simple waves forming a complex wave is reproduced in Fig. 93 with the addition of the vertical line mn drawn through the ordinate kl of the complex wave and continued through the corresponding ordinates of the three component waves. The fundamental wave gk is the simple sine wave $y = A_1 \sin x$. The wave ef has a different amplitude, we may call it A_2 and its period is double the period of the fundamental wave, while the third wave cd has again a different amplitude, say A_3, and a period double that of the wave ef. The complex wave ab has no regular amplitude, but its values of the ordinates equal at each point of the wave the sum of the corresponding ordinates of the three other waves. We can check this by measuring. It is $ik = qr + (-ts) + uv$. If we desire to give this equation a general form we would write it $f(x) = A_1 \sin x + A_2 \sin 2x + A_3 \sin 3x + \ldots\ldots$

If we have two sine curves differing in amplitude only, for instance, $y = A \sin wt$ and $y_1 = B \sin wt$, we find the resultant curve to be $y + y_1 = (A + B) \sin wt$, which means the resultant has for its ordinates the sum of the ordinates of the two given curves. This case may represent two equal loops beginning their motion at the same time but the one cutting a less dense uniform field of force than the other. Now suppose that two equal loops rotating with the same speed are not in the same position at the same time, but are offset by an angle; then one loop may have its motion expressed by the equation $y = A \sin wt$, and the other one by the equation $y_1 = A \sin (wt \pm \Phi)$, where Φ is the angle by which the second loop is in advance of, or lags behind, the second loop, according to the sign in the equation. Φ is called the *"Phase"* of the wave.

As an alternating wave changes sign

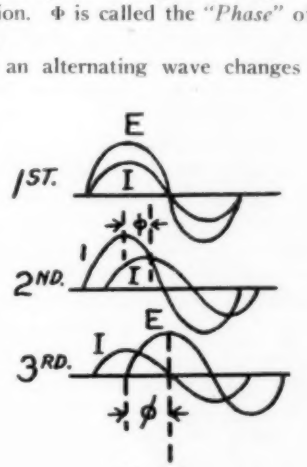


Fig. 94

every time it passes a zero value, we have to treat all magnitudes that alternate in this way as physical quantities possessing direction as well as magnitude. It follows that we must take account of the direction of the angle of lag by referring to the counter clockwise rotation as positive direction.

It can be observed in Fig. 91 that each time the cycle is repeated, the same values are run through. Each maximum on the positive side occurs one quarter of a cycle or 90° after the preceding zero value. The points marked P have the same phase, although they belong to different cycles. At the points marked Q the current has the same value as at the points marked P, but points P and Q are not in the same phase, as the current at points P is in its increasing stage, while it is decreasing at points Q.

As the phase occurs at the same point of each succeeding cycle, we mean by *"Phase Difference"* nothing else but the difference in position in the cycle. It is

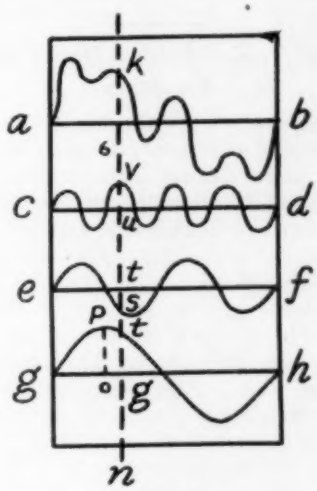


Fig. 93

customary to express the phase difference in degrees of an angle. A phase difference of 90° would mean that the two waves are a quarter of a cycle offset, which means that the highest point of one wave occurs a quarter of a wave length before or after the other wave reaches its maximum. In Fig. 94 are indicated three different phase conditions. The first condition shows two sine curves, one marked E which represents the e. m. f., and one marked I, which represents the current. Both curves have the same form and both intersect the abscissa at the same zero points. This indicates that e. m. f. and current are *"in phase."* There is no phase difference. Such is the case where an alternating current circuit contains resistance only but no inductance or capacity.

In the second condition the e. m. f. E is in advance of the current I by an angle Φ, that means the e. m. f. reaches maximum value before the current. The current lags 90° in phase behind the e. m. f. Such is the case when an alternating e. m. f. is applied to a circuit containing an inductance coil wound with a large wire to render the resistance small. As we have learned before, the changes of the alternating current flowing in the circuit induce an e. m. f. which has its maximum at the points where the current passes through zero. This induced e. m. f. has to be overcome at each moment by the applied e. m. f. which is equal and

opposite to it. The current lags 90° in phase behind the applied e. m. f.

In the third condition we have the case of an alternating e. m. f. applied to a circuit containing a condenser. Here the e. m. f. applied to the condenser lags in phase 90° behind the current, as the condenser has to absorb a great deal of current before its e. m. f. starts to increase noticeably.

Attention is called to the current leading the e. m. f. in the condenser case and lagging behind it is the inductance case by the same phase angle.

New York Divides Down State Territory

New York City—Continuing a policy established over two years ago, to provide more efficient administration and operation of its rapidly expanding system, the New York Telephone Company announced, effective September 1st, the further division of its downstate territory. Under the new arrangement, Manhattan Island and Bronx-Westchester will become separate operating areas, each in charge of a vice-president and general mananger with the necessary staff organization.

For the Manhattan area, M. B. Downing, now General Manager of the Bell Telephone Company of Pennsylvania, will become Vice-President and General Manager, while J. P. Downs, at present General Traffic Manager—Downstate, will be in charge of the Bronx-Westchester area as Vice-President and General Manager.

Mr. Downing began his telephone career in 1899 with the New York Telephone Company as a traffic inspector. After two years he became manager of the Franklin Exchange, and later had various important traffic assignments in the upstate territory. His next service was as Acting Superintendent of Traffic for the New Jersey Division, and in 1912 he went to St. Louis as General Traffic Superintendent in Missouri and Arkansas for the Southwestern Bell Telephone Company. Four years later, in 1916, he went to Detroit as General Superintendent of Traffic for the Michigan Bell Telephone Company. In 1919 he became associated with the Bell Telephone Company of Pennsylvania in a like capacity, and in 1922 was made general traffic manager, in 1923 general commercial manager and since 1926 he has been general manager of the eastern area of that company.

Mr. Downs, who becomes vice-president and general manager for the newly created Bronx-Westchester area, entered the Bell System in 1893 at Cleveland, Ohio, doing plant and engineering work. In 1902 he joined the American Telephone and Telegraph Company organization doing special engineering and traffic work among the various Bell companies until 1907, when he went to the Pacific Telephone and Telegraph Company to become traffic engineer and later general superintendent of traffic for that company. In December, 1919, he became associated with the New York Telephone Company as assistant to the first vice-president, which position he held until November 15, 1920, when he became general traffic manager.

To further promote efficiency of operation throughout the entire territory of the New York Telephone Company by co-ordinating the policies and operating methods of the various areas, a new position has been created, namely, a vice-president in charge of staff functions. H. C. Carpenter assumes this very important position to which he brings his long experience in the telephone industry which has included the position as chief engineer when the company was operated as a single territory, and his present office as general manager of the downstate territory. Other organization changes include the following: J. J. Robinson, general manager of the Long Island area, and J. W. Hubbell, general manager of upstate, each becomes vice-president and general manager for his respective territory.

Indiana Plans Its Biggest Convention—September 20-22

Indianapolis, Ind.—Indiana expects the eighth annual convention of its state telephone association to be by far the biggest and liveliest meeting in the history of that body. The meeting will open with the address of President Henry A. Barnhart at 2 p. m., Tuesday, September 20. More than 90 per cent of all the stations and toll lines in the state are owned by the 182 members of the association, so the sessions are certain to be well attended. A good idea of the practical and interesting character of the program which will be staged at the Claypool Hotel may be had from the following line-up:

Tuesday, September 20

Forenoon

10:30—Registration, 8th floor of the hotel. Visiting telephone exhibits. Greeting old friends and meeting new ones.

12:00—Meeting, board of directors.

Afternoon

2:00—The president's annual address, Hon. Henry A. Barnhart, Rochester. Secretary-Treasurer's report, Chas. S. Norton, Indianapolis. "A Review of National Telephone Affairs," F. B. MacKinnon, Chicago, president U. S. Independent Telephone Association. "Selling Telephone Service," A. D. Lewis, Indianapolis, division commercial superintendent, Indiana Bell Telephone Company. Appointment of committees. Introduction of resolutions.

6:30—An evening with the exhibitors.

Wednesday, September 21

Forenoon

10:00—"Necessity of State Wide Regulation," Carl Wilde, Indianapolis, formerly director of service for the Public Service Commission of Indiana. "The Safety and Security of Our Business," Frank E. Bohn, Ft. Wayne, vice-president and general manager of the Home Telephone and Telegraph Company. "Engineering as Applied to the Telephone Business," A. L. Stadermann, Terre Haute, secretary and engineer of the Citizens Independent Telephone Company. "How Things Are Done in Ohio," C. L. Jones, Athens, Ohio, president of the Ohio Independent Telephone Association and the Athens Home Telephone Company. Questions and answers.

Afternoon

2:00—The operators' session. Open to all persons attending the convention.

Special program conducted by Miss Belle Bernetha, Rochester, chief operator of the Rochester Telephone Company, and C. R. Woods, Indianapolis, general traffic superintendent of the Indiana Bell Telephone Company.

Evening

6:30—Banquet. Address, "Things in General," Hon. Frederick Landis, Logansport. Music and dancing.

Thursday, September 22

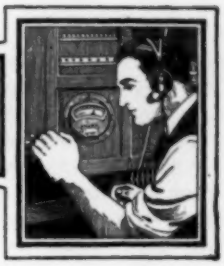
Forenoon

10:00—"How to Handle Service Stations," R. V. Achatz, Aurora, president, The Southern Indiana Telephone Company. "I. C. C. Depreciation Order 14700," Harry Boggs, Indianapolis, member of the firm of Herdrich and Boggs, accountants. "Centralized Accounting," O. L. Doud, Seymour, comptroller, Southern Indiana Telephone and Telegraph Company. "Organization and Reorganization," Chas. S. Norton, Indianapolis, secretary-treasurer, Indiana Telephone Association. Report of committees. Election of directors. Unfinished business. Adjournment.

Page Made President of Bell Securities

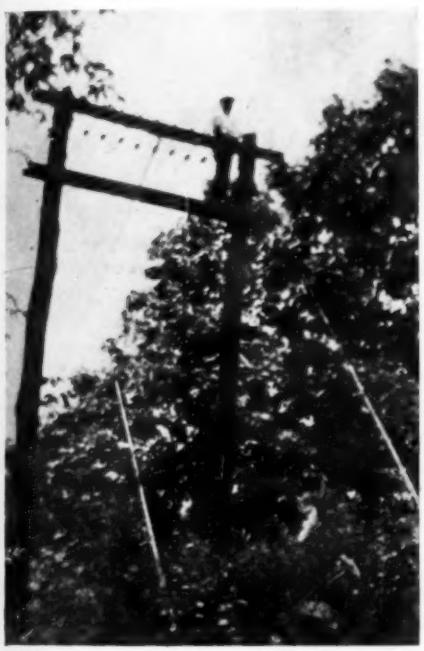
New York City—Arthur W. Page, vice-president of the American T. and T. Co., in charge of public relations, has been elected president of the Bell Telephone Securities Co., succeeding David F. Houston, who resigned to become president of the Mutual Life Insurance Co. of New York.

LINE AND DESK



SOME H-FIXTURE CONSTRUCTION

In response to a S. O. S. broadcast through our Line and Desk department, we have received a number of pictures of H-Fixtures which show some of the details of this type of construction. H. H. Fryer of Bloomington, Ill., sends a photo of the office test pole at the A. T. and T. test station at Bloomington. This is not the typical H-Fixture used in open



One End of Ohio Fixture

wire lines but has a number of interesting features to which attention may be called. The open wire lines are dead ended on break-irons and are carried into the test station through cable. The pin spacing is apparently closer than on the normal cross-arm and power wires as well as telephone wire are carried on the pole. The use of two poles, however, is typical of the usual H-Fixture construction.

C. W. Kugelman, Plant Superintendent of the Portsmouth (O.) Home Telephone Co., a frequent contributor to these columns, sends kodak view and a description of an H-Fixture used to support a long span across the Ohio River at that point. Mr. Kugelman's description is as follows:

"As you seem to be having some difficulty procuring cuts of H-Fixtures, I am enclosing two kodak pictures of one that has been in use for the past seven years on the Kentucky side of the Ohio River, opposite Portsmouth. I trust the cuts will help you.

This fixture is made up as follows. Two 40 ft. 10 in. top best quality chestnut poles, creosoted butts, set 8 ft. deep and tamped in with concrete.

The top cross arm is 4 in. x 6 in. x 10 ft. best quality oak, hewed not sawed from the heart of an almost perfect first growth tree.

The lower pieces are good grade pine 2x4s 10 ft long and serve as foot rest for lineman working on the fixture.

Both oak and pine were thoroughly treated with creosote.

This fixture was placed on a hillside and is the dead end for 12 No. 8 plow steel wires serving for a river span of 2,000 ft. in length.

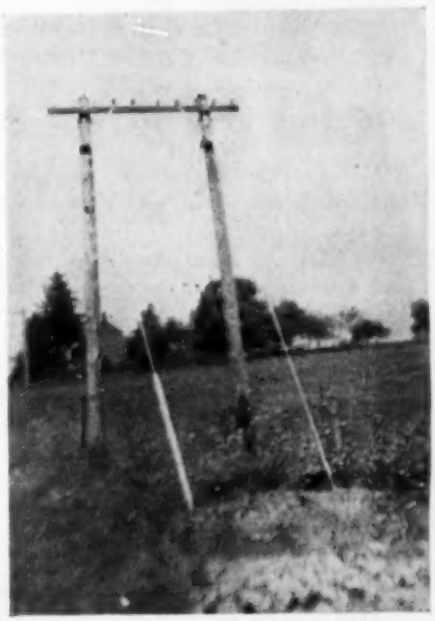
Each pole of the fixture is head guyed with two strands—6,000-lb. strand, three ways. The oak piece is guyed in the center to heavy rod and slug or dead-man in hillside almost level with the timber. All anchors are 7 ft. x ¾ in. rods, at the bottom of which are 5ft. x 10 in. to 14 in. chestnut treated slugs. The one holding the arm being a cross piece or two slugs.

H Fixture at Bloomington

The wires are dead-ended in 15,000-lb. strain insulators to which are made up 6,000-lb. strand loops which are placed in hooks held in place by Pierce No. 549 clevises over the timber.

The size of insulator used was not so much for its tensile strength as for its dead-ending surface.

Plow steel wire cannot be successfully dead-ended in a small loop or around a small insulator. Neither can it be made up or spliced as other wire. It should be served with wrapping of 14 galvanized wire. Our splices and dead ends being 18 inches long.



One of Kugelman's H Fixtures

As heating has a tendency to weaken wire, spices are not soldered. Dead ends are left with extra long tip beyond the makeup. The bridle wire is carried out and around the dead end to the tip. It is then soldered and tapped to the tip.

As spans of the length stated are susceptible to a large amount of vibration, care must be given to all connections. If bridle wires are left loose they are likely to crystalize and break in a few months.

This fixture will likely soon be a thing of the past as today we placed a 50-pair 19-gauge cable on a new bridge spanning the Ohio River at this point. This cable was pulled a distance of 1,850 feet without a splice between terminals.

Another contributor sends a snap shot of a fixture which is typical in construction but which is unusual in that this type of fixture is seldom used in lines of

only one cross arm capacity. We are told that this is used on an important line and in a location where soil conditions make extra support necessary at intervals along the line. The location is south and the ground seldom freezes. During the winter months the soil becomes very soft and high winds and occasional sleet causes the poles to be blown out of line and occasionally pushed out of the ground. These fixtures are installed at intervals of approximately one mile and while they are not a year old, it is expected that they will contribute to the strengthening of the line when the test comes during the coming winter.

As will be seen, the fixture consists of two poles,, each of which is guyed in both directions with the line. The outer guy is protected by a galvanized guy guard. It is assumed that the inner guy is sufficiently close to the fence line to make the guard unnecessary.

DID THIS EVER HAPPEN TO YOU?

A tragedy in one act with the scene laid somewhere about 4:15 p. m. on a hot day.

Foreman: All right, buddy, here's your job. Get our stuff off the truck while I look around.

Installer (to self): What's the matter, are your arms broke?

Foreman (calling from yard): You'll need two T knobs, two S knobs, five pole brackets, about 900 feet of parallel, some tape, a couple of Allens, a tube, a directory, a 534A, a 20 A. L. protector, 50 feet of triple, 300 feet of ground, a ground rod, a ladder and—I guess that's all.

(The lights are darkened to indicate the passage of five minutes.)

Installer enters yard draped with wire, ladders, tools, etc. The foreman goes to the door and raps. No response. Raps again. Still no answer.

Foreman: Well, nobody home. Put that stuff back on the truck.

Sc. II. Same as Sc. I.

Installer puts material on truck and settles down for a cool ride to the next job. The foreman turns the switch key. A window opens.

Feminine Voice: This is the right place, Mister. I was giving Fido his bath and I couldn't open the door for fear he'd catch cold.

The installer begins to talk to himself.

Foreman: What's that? Hey, what's the matter?

Installer: I'm a worn out nut; put me on the junk pile.—H. T. Tietjens, in the Southwestern Bell.

BUGS WE HAVE SHOT

A few days ago I went to a nearby village to locate trouble on a report of "telephone weak." The telephone line was a grounded party line and the telephone was located in the village meat market. I tested the instrument and found it O. K. but could scarcely hear the operator and she told me that he could not hear me very well. The butcher told me that sometimes he could not ring the operator while the telephone in a store in the other part of the building had no trouble. To test the generator, I threw a short on the terminals with my pliers and got a nice shock when I turned the crank. Suspecting trouble with the ground connection, I went over the wiring and found what I thought was the ground on the same rod with the store telephone. It was a good soldered job on a galvanized rod driven in wet ground, so no luck there. I went over the wiring again and finally found that the ground wire was entirely open between the rod and the telephone. As the installation had been made with annunciator wire and the floor in the meat market was usually damp, I finally figured out that there was enough leakage through the insulation to give some kind of service even with the ground connection disconnected. This also accounted for the shock I got when I turned the crank with a short on the generator.—Contributed.

Check Cords on These Three Points . . .

There are only three governing factors that make cord value—**material, manufacturing equipment, labor.**

Every last bit of raw material entering into the manufacture of Runzel-Lenz cords is purchased on a quality basis regardless of price and all incoming raw material is carefully checked by our laboratory.

During our specialization of more than a quarter of a century in cor manufacture we have developed our own machinery that assures excellence and uniformity of output and the lowest possible manufacturing cost compatible with quality.

The Runzel-Lenz factory personnel consists of men and women who have been with us for years and are conscientious experts in their lines.

The result of this alliance of the best material, the best methods and the best labor in the Runzel-Lenz factory guarantees to you cords that are the greatest value you can get for your money. Every inch of Runzel-Lenz cord is carefully tested before shipment. Specify Runzel-Lenz cords and you solve your cord problem.

RUNZEL-LENZ ELECTRIC MFG. CO.

1751 N. Western Ave. CHICAGO

Blending Technical and Practical Training

By RAY BLAIN

One of the many easy ways to start an argument among telephone men is to bring up the question as to what special training a man should have to make a success in telephone work. A technically trained man as referred to in this article is one that has graduated from some recognized school or technical college and a practical trained man is one that learned the profession by starting in a minor position and working his way up in the business.

This question was first brought to my attention some years ago when various telephone companies began the practice of hiring young men just out of college and starting them as students in the various kinds of practical telephone work. Not a few of these men had an exalted opinion of their own ability and looked down on the practical man who had grown up with the telephone business and acquired his knowledge by hard knocks. Their superior attitude frequently caused ill feeling between the two classes of men which still may be found in certain places. As a matter of fact, men of both classes have been successful in telephone work although they have arrived at their success by different routes.

We will first consider the technical trained man who is a success in the telephone world. He will usually plan every move in detail before he starts any project, considering in his plan every possible condition he thinks likely to occur, based on set rules and formulas and his plan must be complete in every detail before he starts on the work. After the job is under way, should any condition be encountered that the plan does not cover, he will delay action until the plan can be revised to cover the change in conditions. He may have a tendency to imitate rather than originate.

The practical man does not care so much about a plan but would rather start the job as soon as possible and then work out the details as the work progresses. He usually has a fair idea as to what the completed job will be but does not know in detail just how it will be accomplished. He may do a few things wrong the first time, but that does not bother him for the mistake will usually indicate the right way, so he tries again and can cover up numerous mistakes if necessary by an increase in action. I have known numerous men who "get by" not on their knowledge so much, but by their accomplishments by being exceedingly active.

The man of least value, be he technically or practically trained, is the one that does not keep his mind open to new ideas and will not consider a method of doing a thing unless he is assured that this method has been tried and found to be sound. In other words he will not consider other than the well beaten paths. Such a man is not progressive because he is living in the past and is not quick enough to grasp new ideas that would increase his efficiency. I met such a man of the old school recently who stated that the automatic was worthless, common battery was only a necessary evil that had to be tolerated and that local battery was the only real telephone service.

I have never been able to see a good reason why a promising idea could not be tried out if it did not entail serious loss. If it is found lacking it can be abandoned for some older method. This I believe is the usual way of improving methods, advancing our ideas and making great discoveries. If we desire to accomplish an objective and can not figure out any definite plan of action then try something that may accomplish the desired result. If it fails then try something else. Thomas A. Edison is a cut and try man and we all know what he has contributed to the electrical industry.

There is a story, the truth of which I cannot vouch, that a few years ago when amateur radio stations were given wave lengths below 200 meters, it was thought that it was impossible to communicate over any great distance on these frequencies with the limited power usually available to the amateur. Being thus restricted he would soon cease to be bothersome. These same amateurs got busy and tried everything and eventually spanned the Atlantic and then practically the longest distance on the globe. Feats were accomplished which the wiseheads had stated were impossible with the wave band and power used. The amateurs either did not know or did not care, so they accomplished what was thought to be impossible in accordance with all known rules at that time. This accomplishment, the result of trying everything and not working along set rules, without a doubt gave us high frequency radio transmission several years ahead of the time it might have been discovered through scientific research in the usual manner.

Build to a Plan

I knew one man technically trained whom I believe to be the most thorough in his methods of any person with whom I ever came in contact. When he had an idea of something new he would make a set of drawings complete in detail. He would then build the apparatus true to the drawings and in a permanent manner. He would never permit any makeshift or temporary work even on a piece of equipment while in the experimental stage. After completion the apparatus was run through a series of so rigid that every defect would be brought out. He would then make various notes of the defects and possibilities of their elimination and improvement. Then he would take the original drawings and revise them to cover the necessary changes as indicated from the notes. As a result of his painstaking methods his accomplishments were many.

Some few years ago I found it necessary that I supervise the erection of two 90-foot white cedar poles that weighed about 4,000 pounds each. I was in doubt as to the best method of accomplishing it so consulted an old construction foreman. He stated that it would be impossible to erect a pole such as this without the use of a 50-foot gin pole and a block and falls to erect the higher pole. I explained that I had seen towers raised by passing a line over a riser at the base to give a lift on the tower until it had raised far enough to give a line a direct pull to erect it. I believed that a similar arrangement could be used on the poles providing the holes were trenched. He voiced his contempt for my plan, saying that it was the most idiotic that he had ever heard and that he had been doing line work for over forty years. This was rather discouraging, but being in a hurry and not wanting to waste time erecting the gin pole I finally mustered up enough courage to try my plan. The hole was trenched to the bottom and a riser constructed by lashing two small 25-foot poles together about two feet from the top and spreading the butts about fifteen feet. The ropes were tied to the large pole about three-quarters of the distance from the butt and passed through the crotch of the riser which was set on end near the hole and then passed over about 200 feet to a caterpillar tractor which

was to be used for the hoisting. Three guys were passed from the top of the pole to anchors placed at suitable locations with men stationed to take out or pay out rope to hold the pole in proper position as it was being raised. No trouble of any nature was experienced. The riser fell out after the hole had raised to a height to make it useless and it was hoisted the remainder of the distance on a direct pull. This scheme, while never tried before in that locality, on a large pole was so successful that I will never use a gin pole on a similar job providing that a winch or any other means of power hoisting is available.

"Cut and Try" Is Leader

There is no doubt that today telephony is being developed along scientific lines and that each improvement is planned in detail more or less before being accomplished. However, I doubt very much that we would have our present-day systems if there had not been a bunch of "cut and try" artists busy who in the early days in their desperation while wrestling with the numerous problems "tried everything" and in so doing stumbled on to ways of eliminating the various defects. The majority of the recent developments have been an application of the old principles to larger systems.

It is conceded that the man with a technical training has a decided advantage over the one without it if his knowledge is properly applied.

The practical man who, although handicapped by lack of proper training, has accomplished much, would probably have accomplished more with the advantage of technical schooling. But the man that proves best under all conditions is the one who comes out of the technical school and then starts from the bottom with a sincere desire to learn the application of his knowledge in his chosen profession by the hard knocks of experience in actually doing the work. The proper fusing of the technical training with the practical experience, along with a willingness to try out a new idea when the occasion comes is the foundation of success of those who will be the future leaders in the telephone field.

Blair, Neb.—E. C. Hunt has bought telephone plant at Center, Mo., from H. W. Couch, who has owned it for 23 years.

Mendon, Ill.—Mendon Telephone Co. has bought properties at Mendon and Fowler, Adams county, from Charles A. Chittenden.

Wheaton, Mo.—Clyde Gardner has bought Wheaton telephone plant.

Western Electric Men Get Good Views Abroad

New York City—Three Western Electric men who are now in Europe have been notified by cable of their promotions to important posts in the organization. They are W. F. Hosford, who will become comptroller of manufacture in succession to James W. Bancker, recently elected a director of the company and vice-president in charge of Purchases and Traffic; David Levinger, who will succeed Mr. Hosford as engineer of manufacture; and J. R. Shea, who becomes superintendent of manufacturing development, the post formerly held by Mr. Levinger.

All three men have been connected with the Western Electric Company for a number of years. Mr. Hosford, the new comptroller of manufacture, joined the organization in Chicago in 1900, where he remained until two years ago when he was transferred to the New York offices. Mr Levinger and Mr. Shea, both of whom have been with the company for nearly twenty years, have made their headquarters at the Hawthorne Works in Chicago.

The men were in Koln, Germany, when notification of their promotions was cabled to them. Their presence in Europe at this time is in line with the policy of the Western Electric, which sends representatives of its manufacturing research department abroad at frequent intervals so that they may be kept informed of the foremost manufacturing methods of the world. During the course of their travels, which began the latter part of May and will continue until early in September, when they will assume their new duties, they will visit some forty manufacturing centers in England, Scotland, Holland, Belgium, France, Germany, Italy, Switzerland, Sweden and Denmark.

MAGNETO DESK SETS

Western Elec. Co. 1020-AL desk stands with 315 type magneto bell boxes, 2 or 3 bar, 1000, 1600 or 2500 ohm ringers (completely refinished $10.50

Kellogg No. 28 or No. 84 magneto desk sets, 3 bar 1000 ohm..... 9.00

4 bar 1600 ohm..... 9.50

Dean Elec. Co. 3 or 4 bar desk sets..... 7.50

Chicago Tele. Co. 4 or 5 bar desk sets..... 7.50

Leich Electric Co. 4 or 5 bar sets..... 9.00

Buckeye Telephone & Supply Company
Columbus - - Ohio

Announce Additions to Kearney Staff

St. Louis, Mo.—The James R. Kearney Corp., announces the following men having recently joined their sales organization:

A. F. Zerbst, in the states of Florida, Georgia, Alabama, North Carolina, South Carolina, and part of Tennessee. Mr. Zerbst was formerly connected with A. T. & T. of Atlanta, Ga.; general superintendent of the Panhandle Power and Light Co., Borger, Texas; and in the statistical engineering department of the Kansas City Power and Light Company.

Oscar Marcusen, in parts of New York, Ohio, and Kentucky. Mr. Marcusen was formerly with the Iowa State Board of Railroad Commissioners, Des Moines, Iowa, in the capacity of assistant electrical engineer.

Henry M. Hughes, in parts of Pennsylvania, West Virginia and Ohio. He was formerly with the Franklin Steel Co., Electrical Service Supplies Co. of Philadelphia, H. C. Fry Glass Co. of Rochester, Pa., and is now identified with his own selling organization, the Continental Sales and Engineering Co., of Pittsburgh.

A. W. Marshall, in parts of Kentucky and Indiana. Mr. Marshall has his own organization, located in Louisville, Ky.

J. G. Smith, in all of Canada west and north of Port Arthur, with headquarters in Winnipeg, Manitoba.

H. C. Fiske has been transferred to the Chicago territory covering parts of Wisconsin, Michigan, Ohio, Illinois and Indiana and E. J. DeRight now is covering parts of Missouri, Arkansas, Mississippi, Tennessee, Kentucky and Illinois.

BRIDGING twisted pair to twisted pair, a practical application of the Kearney Solderless Service Connector.

FOR Telephone Lines in making party line taps, order Catalog No. 86. The tap can't slacken off. This connector is for No. 12 wire or smaller.

Unassembled Connector

ASK ABOUT KEARNEY CERTIFIED MALLEABLE SCREW TYPE ANCHORS

JAMES R. KEARNEY CORPORATION ST. LOUIS, MO.

4226M Clayton Ave.

Kearney Guy Wire Serving Clips. Eliminate Serving End of Strand. Made of Aluminum, Copper, and Galvanized Iron.

Telephone Relics and Historical Data

The Independent Pioneer Telephone Association are arranging to have an exhibit of relics of early independent telephony at the coming convention to be held in the Hotel Sherman, Chicago, October 18, 19, 20 and 21. Also to include historical data pertaining to early telephony.

You no doubt have something of this nature. If so, send them by express to J. K. Johnston, Secretary I. P. T. A., Hotel Sherman, Chicago. To arrive not later than Monday, October 17th.

If you do not care to donate same to become a part of the permanent exhibit to be placed in a museum, or some suitable place to be provided for hereafter, please advise the Secretary and same shall be returned to you after the convention.

Let's make this a good display. Send in whatever relics and historical data you have.

J. K. Johnston, Secretary, I. P. T. A.
903 Lemcke Building,
Indianapolis, Indiana.

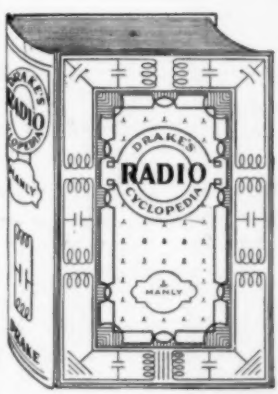
Hotel Cass

644 CASS CHICAGO
Rates—$2.25 & Up

210 Outside Rooms with Bath
H. G. PHILLIPS, Manager

Radio's Complete Manual

DRAKE'S
RADIO CYCLOPEDIA



This practical classic on radio contains 871 pages of profusely illustrated material answering every practical radio question from A battery to Zero beat.

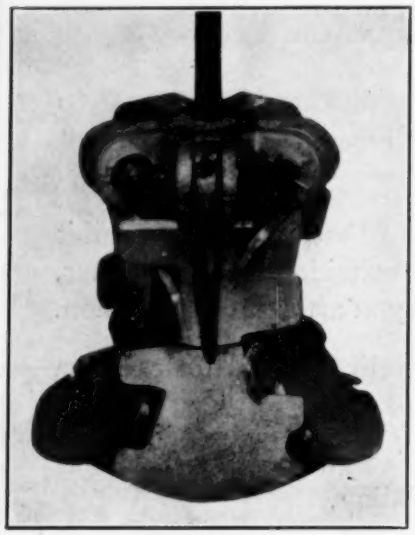
Construction, repair, testing, installation, care and operation of radio receivers and power units are handled in a most thorough and useful manner. It is the most complete radio book in print. Price, $6.

TELEPHONE ENGINEER
236 North Clark Street
CHICAGO, ILL.

Xpandix and Traplox Anchors, New Matthews Items

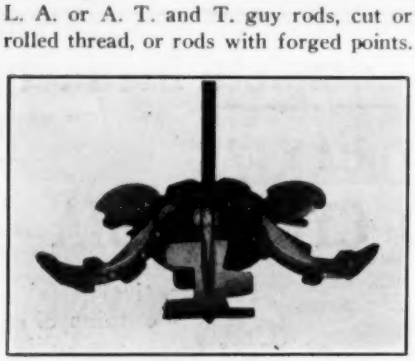
St. Louis, Mo—The W. N. Matthews Corp. announces the addition of two new types of anchors to the Matthews anchor line.

One is the plate type of anchor, known as Matthews Traplox Anchor, and is made in three sizes, Nos. 90, 120 and 160, the numbers denoting the approximate



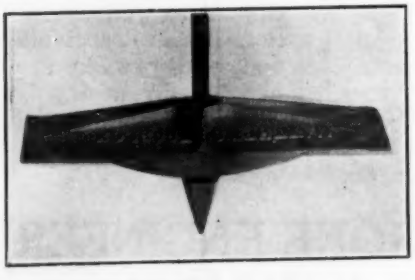
No. 20 Xpandix Anchor, Closed

area of the plate in square inches. They are designed for use with standard N. E. L. A. or A. T. and T. guy rods, cut or rolled thread, or rods with forged points.



No. 20 Xpandix Anchor, Expanded

Anyone using the plate type of anchor, will not have to buy any Matthews installation tools. Those who have been getting satisfaction from the use of plate

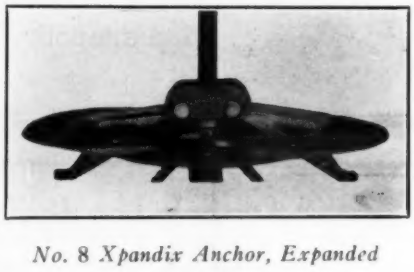


Traplox Anchor

anchors of the same size, will find these anchors more satisfactory because all of their area is closed, and on account of the stress at the joint between rod and plate being evenly distributed around the ball and socket joint, says the Matthews organization.

The other new anchor is the expanding type, known as Matthews Xpandix Anchor, which is made in two sizes—No. 8

No. 8 Xpandix Anchor, Closed



No. 8 Xpandix Anchor, Expanded

two-way and No. 20 five-way. All parts are made of certified malleable iron, and the weight of the No. 8 is two and one-half pounds less than other malleable spread anchors of similar types of same areas.

The No. 8 is recommended for use with 10,000 pound guy strand; the No. 20 for use with 16,000 pound guy strand in ground where it is possible to bore an eight-inch hole six feet deep in not to exceed twenty minutes by two men. An eight-inch hole is all that is needed for the No. 8 or No. 20. The No. 20 is the only five-way anchor made and expands out to twenty inches in diameter.

These two new types of anchors are to be sold through our authorized electrical distributers, who can also furnish guy rods, installing tools, etc.

The W. N. Matthews Corporation will furnish detailed descriptions upon request.

Illinois Boosts Toll Producing Charts

Springfield, Ill.—The Illinois Telephone association has sent to member companies a sample of a toll revenue boosting chart prepared by the Illinois Telephone Company, Jacksonville, Illinois. This chart is designed to be hung in hotels, depots, interurban stations, clubs and other places where the public, especially the traveling public congregates, and the association believes it would be good advertising policy for any telephone company to display a similar chart, showing its popular toll connections, in each of its offices, having a zinc etching made of the chart so that it could be published in the local newspaper in the town where each exchange is located, also. Under present conditions the association office can design a similar chart for member companies, and will be glad to do so, upon request, there being no charge for this service. From the association design a local printer can produce the charts in sufficient quantities as may be needed.

Creosoted Pine Poles Increase 800% in Nine Years

Chicago, Ill.—Pressure creosoted pine poles are steadily gaining in demand, according to figures prepared by the U. S. Forest Service in co-operation with the American Wood-Preservers' Association, just released. The total number used in 1926 was 925,929, an increase of 18.7 per cent over the previous year, and an increase of almost 800 per cent over the 103,804 poles of this kind installed nine years ago.

Public Utility Financing

P. W. CHAPMAN & CO., INC

170 W. Monroe St. Chicago — 42 Cedar Street New York

Boston Albany St. Louis Milwaukee Grand Rapids
New Orleans Seattle Portland San Francisco

For Maximum Service—Baker Contact Points

DEPENDABILITY and long life are the two essentials in a contact point. This "heart of the machine" should function evenly and steadily over long periods of time—it should not need replacement at frequent intervals.

Baker Contact Points are made with this principle always in mind and the name "Baker" assures that perfect performance, without constant renewal, which is the outstanding characteristic of a *good* contact point. Our contacts are made of Platinum, Iridio-Platinum, Silver and Special Alloys. There are sizes and types for all purposes.

BAKER & CO., INC.
54 Austin St., Newark, N. J.
NEW YORK CHICAGO

Announcing— *the* **Highway Earth Boring Machine**

Bores the Hole--Sets the Pole

A pole in the ground every five and one-half minutes is the record recently made on new line construction—under actual operating conditions. A three-man crew with the Highway Earth Boring Machine and Pole Setter bores the holes, sets the poles and moves from position to position all in this remarkable time. A saving of 75% of the time required for the same work by any other method.

The machine mounted on a Fordson or International Harvester tractor, equipped with crawlers, negotiates steep grades and swamps and easily reaches ninety percent of all locations.

Write for complete information

HIGHWAY TRAILER COMPANY
EDGERTON, WISCONSIN

HOTEL FORT SHELBY
LAFAYETTE AND FIRST DETROIT

WHETHER your choice be one of the many very comfortable rooms at $2.50, $3 or $4, or one of the richly furnished suites in the 22-story recent addition, whose sunny bay windows give an entrancing view of city, river and Canadian shore, you will enjoy a special sense of value in Hotel Fort Shelby.

All rooms have Servidors. Convenient to all downtown; principal shops almost at the door. Garage in connection; cars delivered without service charge. Excellent facilities for conventions.

Brochure on Request.

Over Half a Million in Use

Vacuum Grip
REG. U.S. PAT. OFFICE
PLIERS

Your Name Etched FREE on Handle

Built for the Lineman!

IF any pliers ever get the "bad breaks" it's the lineman's pliers. They're up against a tough proposition from the word go—and it takes a husky tool to stand the racket.

When we designed Vacuum Grip No. 58 we studied the linemen's needs and *built a pair of pliers to meet them.* No. 58 is *your* plier—made to do *your* kind of work—*without breaking down!*

They are *not made of ordinary carbon steel, case-hardened* but of high grade electric furnace tool steel, *HARDENED HRU AND THRU* and tempered in oil.

GUARANTEED to give 100% satisfactory service or purchase price refunded.

No. 56—6 in., price $2.25; No. 57—7 in., price $2.75; No. 58—8½ in., price $3.50. We pay parcel post.

If your dealer can't supply you use the coupon. Write for Catalog of 38 sizes and patterns. PURCHASING AGENTS, send for samples for your men to use in running tests.

FORGED STEEL PRODUCTS CO.
Newport, Penna.

FORGED STEEL PRODUCTS CO.,
Newport, Penna.

Enclose $..... (Money Order) for one pair No. ..... Vacuum Grip Pliers.

Name .....
Street .....
City ..... State .....
T-9

Lankford General Commercial Agent Illinois Bell

Chicago, Ill.—H. G. Lankford, formerly chief commercial agent of the Illinois Bell, has been appointed general commercial agent of the company, a new position on the staff, working with A. R. Bone, general commercial superintendent. His work will include handling relations with the state's Independent companies, activity for which he is well qualified due to his long experience in the state's telephone industry and his wide acquaintance and his standing, both of which were indicated by his election to the vice-presidency of the Illinois Telephone Association.

Alpena, Mich.—Emmett P. Platt has been named general manager of the Onaway-Alpena Telo. Co. He formerly was manager of the Dowagiac Telo. Co. and mayor of Dowagiac.

Prisk Is New Penna Bell Eastern Chief

Philadelphia, Pa.—Edward M. Prisk of Hazelton, Pa., vice-president and general manager of the Lehigh Telephone Co., on September 1 became vice-president and general manager of the Bell Telephone Co. of Pennsylvania for the eastern area and vice-president and general manager of the Diamond State Telephone Co., operating the state of Delaware.

Mr. Prisk is one of the best known active telephone men in Pennsylvania, having been associated with the telephone business of that state for 28 years, starting as a clerk with the Peoples Telo. Co. of Wilkesbarre.

Moore's Michigan Property to Expand

Caro, Mich.—Charles W. McKay completes appraisal of Moore Telephone System. Reproduction value put at $704,213. Big expansion is planned for the Moore system.

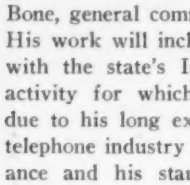
Staples and Young Rise in Penna. Bell

Philadelphia, Pa.—Philip C. Staples, formerly vice-president in charge of public relations and personnel for Bell Telephone Company of Pennsylvania, has been made vice-president in charge of operations. Hobart C. Young, formerly general commercial manager of eastern area, succeeds Staples.

Phone Fisherman After "Laziest Man" Title

Nelson, B. C.—Candidate for distinction as world's laziest man is discovered by telephone man who found one of his company's subscribers had connected fish pole and telephone circuit so telephone bell would announce nibbles on his line.

Eaton, O.—Construction begun on new telephone building.



CHAPMAN
LIGHTNING ARRESTERS
MADE BY
MINNESOTA ELECTRIC CO
MINNEAPOLIS, MINN.

As low as $18.00 at Chicago

Addressograph

CHEAPER than typewriter—SAVES 20% of YOUR present costs—5 to 15 times FASTER and BETTER than pen or typewriter.

FREE TRIAL will prove it.

904 W. Van Buren St., Chicago, Ill.

CROSS ARMS

Fir—Yellow Pine
Plain or Treated
LOCUST PINS, OAK BRACKETS, ETC.
All cross arms manufactured and shipped from Baltimore, Md.
GULF CROSS ARM CO.,
Fairfield, P. O. Baltimore, Md.

J. G. WRAY & CO.
Telephone Engineers
Specialists in Appraisals, Rate Surveys, Financial Investigations, Organization and Operation of Telephone Companies.
J. G. Wray, Fellow A. I. E. E.
Cyrus G. Hill
1217 First National Bank Bldg., Chicago

SCRAP PLATINUM
Highest prices paid for discarded or obsolete telephone and switchboard apparatus; platinum contact relays, ring keys, etc. Have specialized in this field for many years.
CONTACT METALS CO.
2300 S. Wabash Ave., Chicago

Rate Cases Valuations
Charles W. McKay
FINANCIAL REPORTS
448 Wrigley Building Chicago
Phone Superior 3016

RECONSTRUCTED EQUIPMENT

Western Elec. No. 1317 2 or 3-bar 1000, 1600 or 2500 ohm Bdg. compacts @ $8.25—with Stromberg 4-bar Gen. @ $9.00—5-bar @	$10.00
Federal Brand New 4-bar 1000 ohm Bdg. Grab-a-Phones @	8.50
Federal Brand New 4-bar 1600 ohm Bdg. Grab-a-Phones @	9.00
Cook No. 10 Arresters, per bank of 20 lines @	8.50
Cook No. 8 Arresters, per bank of 20 lines @	8.00
Stromberg No. 599 type 4-bar 1000, 1600 or 2500 ohm Bdg. compacts @	6.90
Bunnell 50 ohm Automatic Pen Registers. Register calls from Police or Fire Alarm boxes @	20.00
Kellogg No. 20-A Cord Ckt. Repeating coils @	1.25
Kellogg No. 128 Twin Swbd. condensers @	1.00
Leich Elec. No. 7A Frequency converters @	37.50
Bunnell Telegraph Keys @	.50
General Elec. (THOMAS), A. C. Ammeter, Scale 0 to 2 amps, @	5.00
Dean Elec. 3-bar 1000, 1600 or 2500 ohm Bdg. desk sets @	8.75
Kellogg No. 28 3-bar 1000, 1600 or 2500 ohm Bdg. desk sets @	9.50
Western Elec. No. 296A Straight line C. B. Wood hotel sets with No. 229 Trans., No. 143 Rec., No. 20 Coils and 2500 ohm ringer @	6.50
Menominee Elec. Extra Heavy duty Swbd. Gen., complete with mounting screws, crank, etc., 6-bar @	2.75

Write for our Bulletin
REBUILT ELECTRIC EQUIPMENT CO. Not Inc.
1940 W. 21st St., Chicago

Make Your Directory a Source of Income
Write for Particulars
J. H. WELKER
McKinley Block, Canton, O.
Telephone 8009
DIRECTORY ADVERTISING EXCLUSIVELY

J.K. Johnston, Telephone Engineer
During recent years I have been privileged to appraise Telephone Exchanges all over the United States. The list totals 520. Would you like to avail yourself of my services?
903-4 Lemcke Building, INDIANAPOLIS

Send for free sample and prices on
UNIVERSAL DROP WIRE INSULATORS
Universal Specialty Company
120-A, S. 7th St., Terre Haute, Ind.

CEDAR POLES
Quick Delivery
Prices and Quality Satisfactory "Producer Direc to Consumer"
J. J. SEGUIN CO., Ltd.
Seguin Bldg., 421 St. Paul St.
QUEBEC CITY, P. Q., CAN.

ACCOUNTING
Specialization on Public Utility Accounting Records and Audits enables us to best serve Telephone Companies.
HERDRICH AND BOGGS
Certified Public Accountants
1014 Merchants Bank Bldg., Indianapolis, Ind

Get your
Telephone Repair Work
done at the old reliable
Telephone Repair Shop
SUTTLE EQUIPMENT CO.
LAWRENCEVILLE, ILL.

Automatic Puts Stratton in Minneapolis Office

Minneapolis, Minn.—Automatic Electric, Inc., has opened an office at 952 McKnight building, in charge of A. C. Stratton. Mr. Stratton has been with Automatic since 1913 when he joined the force at Buffalo, N. Y. He has been in charge of a number of installation jobs and has done considerable sales work during the last two years. He has a host of friends in the industry to rejoice at his selection for the most recently opened Automatic sales and service office.

Pasadena, Cal.—William J. Carr has been appointed to the California Railroad Commission to succeed the late Harley W. Brundige.

UNIQUE
BLOW TORCH

It starts quickly, operates in any position, and produces a remarkable heat. It is a great worker in cold and windy weather.

The automatic orifice cleaner, one of the details shown in the illustration, is but one of a number of exclusive features that make the Unique your greatest value in blow torches.

Painstaking care by interested workmen, an actual "burning test" before shipping, is just another detail responsible for their uniformity and efficient burning qualities.

Write for complete details

Unique Manufacturing Co.
221 Whiting St. CHICAGO, ILL.

CHOICE NORTHERN
WHITE CEDAR POLES
LET US SERVE YOU ALSO
REPUBLIC CEDAR CO.
MARINETTE WISCONSIN

Cable Ring Saddle Brought Out by Kearney

St. Louis, Mo.—The James R. Kearney Corp., 4224-32 Clayton avenue, announces the manufacturing of a cable ring saddle for use on cable rings.

According to the manufacturer, it is a means of eliminating ring cutting on the lead cable sheath as it provides a broad surface for the cable to ride on. These cable ring saddles are made of aluminum, in five sizes, for 1½-in. 2-in. 2½-in. 3-in. and 3½-in. cable rings. These saddles can be installed on Bonita and other cable rings.

It is easy to clamp a Kearney Cable Ring Saddle on to a ring, the only necessary tool being a pair of pliers. It is impossible for the saddle to slip up on the ring because of the offset in the ring, says the manufacturer who recommends that two or three of these saddles be used on the rings on each side of the pole where the stress on the lead sheath is greatest. By investigation, it has been found that the cutting action of cable rings is extremely severe when the cable bows or warps the pole causes a severe pressure against the ring. Kearney Cable Ring Saddles are guaranteed to eliminate the possibility of such cutting action.

Harry Engh Goes with Mutual at Erie, Pa.

Erie, Pa.—Harry M. Engh, for the last nine years of his 15 year connection with the American Appraisal Co., manager of that organization's public utility department, has been made manager of the public relations department of the Mutual Telephone Co. Engh has had extensive experience in the telephone business, having worked on utility appraisals in every state in the union, every province in Canada and in all of the West Indies.

He is widely known and popular in the telephone industry, having an intimate knowledge of its problems and being a close and competent observer of general business activities as well.

Thurston and Bibb Promoted by Graybar

New York City—Graybar Electric Co. announces appointment of H. B. Bibb as Sales Manager of the Graybar Norfolk Branch House. Promotion of E. W. Thurston to Assistant Telephone Sales Manager also is announced. Mr. Thurston will now be located at the executive offices of the company.

New York City—Long Lines department of Bell planned additions and improvements to plant during second quarter of 1927 approximating cost of $118,000,000.

C. L. Johnson, Western Electric, Dies

Pittsfield, Mass.—C. L. Johnson, an executive of the manufacturing department of the Western Electric Company, died August 24 in the House of Mercy Hospital in Pittsfield following an operation for appendicitis.

Mr. Johnson, who was 54 years old, was born in Chicago. Two years following his graduation from Cornell he entered the services of the Western Electric Company in Chicago, later going to Montreal as assistant manager of the Northern Electric Company, an associated company of the Western Electric. After a brief period there, he returned to the Chicago works of the company at Hawthorne and three years later was sent to Europe to make special studies in the company's continental factories, then a part of its structure. In 1914 Mr. Johnson returned to Hawthorne to assume the following year the clerical superintendency of the entire plant. He remained in this position until 1923 when he became general clerical superintendent in the office of the comptroller of manufacture with headquarters at 195 Broadway, New York City. In July, 1926, he was appointed office procedure engineer, also in the office of comptroller of manufacture, the post he held at the time of his death.

Mr. Johnson is survived by his wife and four children, Grace Edith, Charlotte Mary, C. L., Jr., and Edward Harold. His home was at New Rochelle, N. Y., with a summer residence at Canaan, Conn.

Caro, Mich.—Miss Vera Marie Moore, only daughter of Mr. and Mrs. W. J. Moore, was married on August 29 to Frederick A. Graham. The bride's father is one of the state's pioneer telephone men with large and lively holdings in Independent telephone property in the state.

CONVENTION CALENDAR

INDIANA TELEPHONE ASSOCIATION,
Indianapolis, Claypool Hotel, September 20, 21 and 22.

UNITED STATES INDEPENDENT TELEPHONE ASSOCIATION,
Chicago, Hotel Sherman, October 18, 19, 20 and 21.

ILLINOIS TELEPHONE ASSOCIATION,
Springfield, Hotel Abraham Lincoln, November 17 and 18.

YOU CAN'T GO WRONG

on the *"ALWAYS RELIABLE"*

Covered by Patents
No. 83 Qt.
No. 84 Pt.

They are truly all that their name implies. They are the result of constant progress towards perfection in the manufacture of torches and furnaces.

Most jobbers stock. Others will gladly order.

OTTO BERNZ CO., Inc., Newark, N. J.

Stocks in Newark, N. J.; New York City; Chicago, and San Francisco.

Offices in Newark, N. J.; New York City; Chicago; Fort Worth; Denver; Helena, Mont.; San Francisco; Los Angeles; Seattle and St. Thomas, Ont.

STANDARD
Copper Clad Steel Wire

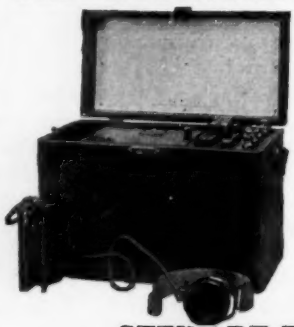
TRADE **C.C.C.** MARK

Combines the strength of steel with the conductivity and rust-resistance of copper. Bulletin 202 explains how you can save money by using No. 17 Copper Clad instead of No. 14 copper.

Standard Underground Cable Co.
General Offices: PITTSBURGH, PA.

Branches in principal cities.

The "STEWART" Cable Tester



Locates shorts, crosses, grounds and wet spots to an inch. Will often save its cost on one case of cable trouble.

Order a "STEWART" Cable Tester and be sure you are going to locate your next case of cable trouble quickly.

Any telephone man can use it. Not an instrument that only an expert can use.

Equipped with two vibrators and an indicating lamp. Write for circular.

Sent on 10 days' trial.

Also, Test Sets, Test Cabinets and Detecto-Meters.

STEWART BROTHERS
OTTAWA, ILLINOIS

Get EVER-PROTECT aid in your construction.

EVER-PROTECT has proved practical and profitable in making many hundreds of cable installations underground without a conduit. It protects cable against storm damage, corrosion, chemical action, electrolysis and abrasion.

In liquid form EVER-PROTECT is great for overhead work, protecting your cable and messengers against chemical action and other destructive influences.

Ask your nearest jobber for complete details.

National Cable Compound Co.
Incorporated
MITCHELL - - IND.

Note Protection at Corners

Blake Insulated Staples

Unequalled for telephone and bell wiring. The fiber insulation prevents troublesome short circuits and grounds. 4 sizes. Pat. Nov., 1900. Write for samples.

Blake Signal & Mfg. Co.
BOSTON, MASS.

Exide
BATTERIES

They do the job for which they were purchased, unfailingly, continually and economically. That, in a nut shell, is the reason Exide Batteries are so extensively used by the large telephone systems of the country.

THE ELECTRIC STORAGE BATTERY CO.
Philadelphia
In Canada, Exide Batteries of Canada, Ltd., Toronto

STANDARD THE WORLD OVER
WESTON
Pioneers since 1888

"REBUILT" TELEPHONE APPARATUS and exchange equipment saves you 30 to 50 per cent without sacrificing quality or efficiency.

SWITCHBOARDS—Telephones—Apparatus—Protection Equipment—Cable—Everything you need for the installation and operation of a complete exchange—Magneto or Central Energy—of the best and most reputable manufacturers.

Fourteen years' successful operation of our rebuilt equipment department puts it past the experimental stage. Quality and price will make you a permanent customer. Better investigate.

BARGAIN BULLETIN NO. 75 FREE
Address "REBUILT" EQUIPMENT DEPARTMENT
Premier Electric Company 1800-4 Grace St. Chicago, Ill.

Columbia
Telephone Batteries
Best by test—they last longer

UNIVERSAL CYLINDER BELLOWS

keep the switchboards and other telephone apparatus free from dust and dirt. One stroke produces a powerful current of compressed air that removes all dust and dirt beyond the reach of a rag. Carried in stock by dealers in telephone supplies, or write direct for literature and prices.

P. PEIFFER
80 LIBERTY STREET
NEWARK, N. J.